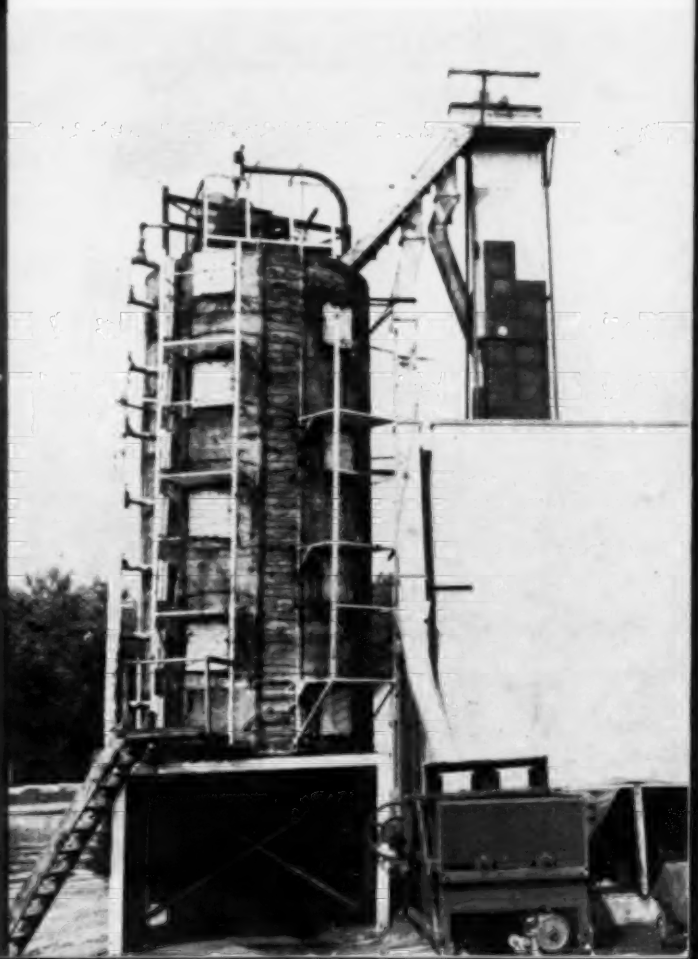
AGRICULTURAL *Chemicals*

IN THIS ISSUE:

- Caking In Fertilizers
- Granulated Insecticides
- 1958 Pest Control Work
- New ESFC Fertilizer Plant
- New Pesticides
- Treating Products Under Quarantine
- Organics in Fertilizer
- Fungicide Review for Dealers



MARCH, 1959

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A frank discussion with us may result in a more attractive bag, reduced production costs and increased sales of your product.

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will handle any free-flowing material l-a-a-t-e-r, with more accuracy, than any bag filling machine of its type!

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First Cover	Codling Moth, Curculio, Leaf Rollers, Leaf Miner, Red Bugs, Mites	Parathion, Dieldrin	GUTHION Alone
Second Cover	Codling Moth, Leaf Rollers, Curculio	DDT, TDE, Parathion	GUTHION Alone
Third Cover	Codling Moth, Mites, Aphids	DDT, Aphicide, Miticide	GUTHION Alone
Fourth Cover	Apple Maggot, Codling Moth, Leaf Rollers, Fruit Worm, Aphids	Lead Arsenate, DDT & TDE, Aphicide, Miticide	GUTHION Alone
Fifth Cover	Apple Maggot, Codling Moth, Mites, Curculio	Lead Arsenate, DDT, Miticide, Parathion	GUTHION Alone
Sixth and Seventh Cover	Codling Moth, Leaf Rollers	DDT, TDE	GUTHION Alone

Now, at last, you can use a *single* chemical to control every major insect pest that attacks your deciduous fruit crops! Against twelve of the most destructive fruit insects—including aphids and mites—GUTHION alone provides equal or better control than any combination of insecticides formerly required! The chart above shows the tremendous advantage of using GUTHION alone, right through the entire spray season.

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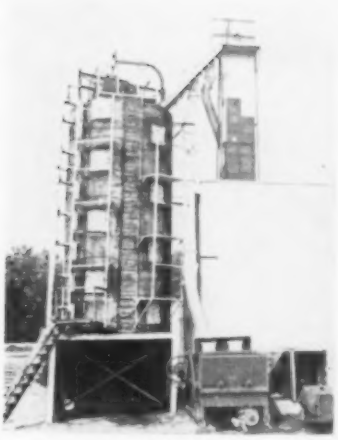

This Month's Cover

Experimental equipment, silo-type in use for processing garbage compost — Michigan State
See story on page 41.

Vol. 14, No. 3 March, 1959

AGRICULTURAL *Chemicals*

ARTICLES

THE CAKING OF MIXED FERTILIZERS AND ITS ALLEVIATION 28
By Simon Kuczynski
PROGRESS IN GRANULATED INSECTICIDES 30
By E. L. Gooden
NEW EASTERN STATES GRANULAR FERTILIZER PLANT 32
COOPERATIVE FEDERAL-STATE PLANT PEST CONTROL WORK 35
By E. D. Burgess
OPPORTUNITIES FOR LIQUID FERTILIZER DISTRIBUTOR 37
WHAT EVERY DEALER SHOULD KNOW ABOUT FUNGICIDES 38
By S. E. A. McCallan
ECONOMIC POTENTIAL IN UTILIZATION OF ORGANIC WASTES 41
By M. S. Anderson
TREATMENTS TO PERMIT MOVEMENT OF AGRICULTURAL PRODUCTS UNDER PLANT QUARANTINE—CONCLUSION 43
By H. H. Richardson and J. W. Balock
BIOLOGICAL CONTROL OF NOXIOUS INSECTS AND WEEDS 47
By C. H. Hoffman
NEW PESTICIDES—CONCLUSION OF A LISTING OF NEW CHEMICALS 93

FEATURES

IN THE SPOTLIGHT THIS MONTH 9
TRADE ASSOCIATION LISTING 9
EDITORIAL 27
THE LISTENING POST 50
By Paul Müller
FERTILIZER VIEWS AND NEWS 53
By Vincent Sauchelli
THE AGRICULTURAL APPLICATOR 55
PEST ROUNDUP 65
By Kelvin Dorward
WASHINGTON REPORT 69
By Donald Lerch
INDUSTRY NEWS 71
INDUSTRY CALENDAR 88
PROFESSIONAL DIRECTORY 123
CLASSIFIED ADVERTISING 123
ADVERTISER'S INDEX 125
TALE ENDS 126

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National Agricultural Chemicals Association, Association Building, 1145 19th St., N.W., Washington, D. C. Lea Hitchner, exec. sec.

National Plant Food Institute, 1700 K St., N. W., Washington, D. C. Paul Truitt and Russell Coleman, executive vice-presidents.

American Potash Institute, 1102 16th St., N. W., Washington 6, D. C. H. B. Mann, president.

American Society of Agronomy, 2702 Monroe St., Madison, Wisc. L. G. Monthey, executive secretary.

American Phytopathological Society, S. E. A. McCallan, secretary, Boyce Thompson Institute, Yonkers, N. Y.

American Chemical Society, 1155 16th St., N. W., Washington, D. C.

Association of Official Agricultural Chemists, P. O. Box 540, Benjamin Franklin Station, Washington, D. C. William Horwitz, secretary-treasurer.

Agricultural Ammonia Institute, Hotel Claridge, Room 305, Memphis, Tenn. Jack Criswell, executive vice-president.

American Society of Agricultural Engineers, F. B. Lanham, secretary, 505 Pleasant St., St. Joseph, Mo.

Carolinas-Virginia Pesticide Formulators Association, 516 S. Salisbury St., Raleigh, N. C. Hugh Horn, secretary-treasurer.

California Fertilizer Association, Sidney Bierly, executive secretary, Suite 1, Boothe Building, 475 Huntington Dr., San Marino, Calif.

Chemical Specialties Manufacturers Association, 50 East 41st St., New York City, Dr. H. W. Hamilton, secretary.

Entomological Society of America, 1530 P. Street N. W., Washington, D. C. R. H. Nelson, secretary.

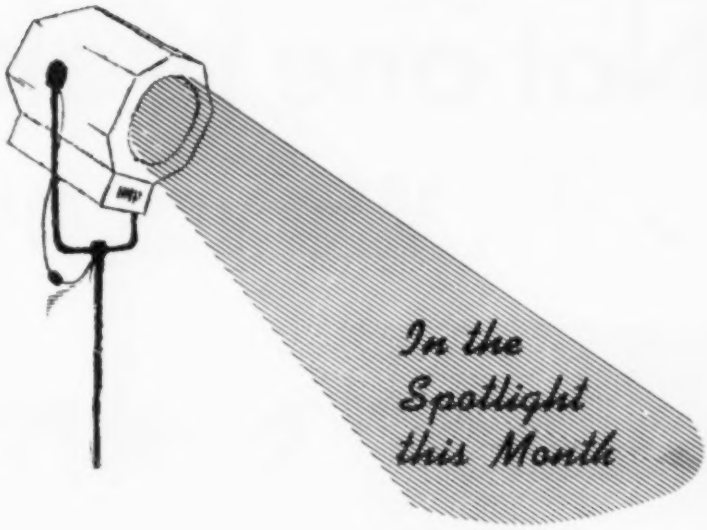
National Fertilizer Solutions Association, 2217 Tribune Tower, Chicago, Ill. M. F. Collie, secretary.

National Cotton Council, P. O. Box 9905, Memphis, Tenn.

Soil Science Society of America, 2702 Monroe St., Madison, Wisc. L. G. Monthey, exec. sec.

Weed Society of America, W. C. Shaw, secretary, Field Crops Research Branch, Beltsville, Md.

Western Agricultural Chemicals Association, Charles Barnard, executive secretary, 2466 Kenwood Ave., San Jose, Calif.



- **Federal-State Pest Control** . . . Part of the USDA program against plant pests includes survey, control and eradication work. In 1958, some twenty specific pest control programs were underway. Reviewed in this article is the status of control measures against: grasshoppers, Mediterranean fruit flies, Hall scale, Mormon crickets, fire ants, gypsy moths, Khapra beetle, pink bollworm, witchweed, nematodes, white-fringed beetle, Japanese beetle, and Hoja blanca disease of rice. Page 35.

- **Caking in Fertilizer** . . . To minimize caking problems, a Brazilian fertilizer manufacturer suggests use of a water spray during mixing, addition of 2% rock phosphate and use of fresh superphosphate. Page 27.

- **Review of Fungicides** . . . Discussion of an elementary nature directed to dealers, salesmen, and others interested in agricultural chemicals,—reviewing fungicides based on copper, sulfur, mercury, and organics; plus an analysis of the basic question "what causes disease in plants?" Page 38.

- **Granulated Insecticides** . . . Attainment of desired granular characteristics for a formulation lies primarily in the choice of a carrier. Insecticides themselves generally have no granular character of their own. Page 30.

- **Plant Quarantine** . . . Conclusion of a two-part article reporting on the treatments involved to permit movement of agricultural commodities under plant quarantine regulations. This installment reviews hydrocyanic acid fumigation, use of DDT, chlordane, dieldrin and several other chemicals; cold treatment; heat treatments and irradiation. Page 43.

- **Granular Fertilizer Plant** . . . Eight different grades of granulated fertilizers are produced at Eastern States Farmers Exchange new fertilizer plant at Detroit, Maine. The design allows for automatic unloading, and bulk handling of raw materials. Annual capacity is rated at 30,000 tons. Page 32.

"Not one broken bag with WONDERWALL®!"

"The biggest breakage problem in our plant had been when bags were moved from one place to another by cart or hand truck. Now, with WONDERWALLS we've eliminated that problem. Three thousand tons of meal are packed in 100,000 50-pound WONDERWALLS because they do the job," Mr. Paulson says.

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what's your E.Q.?*

QUESTIONS

	True	False
1. Inorganic salts are frequently added to oil-water systems to break emulsions.	☐	☐
2. It is impossible to prepare practical emulsions in which the aqueous phase contains high concentrations of inorganic salts.	☐	☐
3. Good agricultural emulsifiers may be characterized as individual specific chemical compounds.	☐	☐
4. The anionic components of an agricultural emulsifier impart improved performance in soft water.	☐	☐
5. A good emulsifier can be fully characterized by the ratio of anionic to nonionic components.	☐	☐
6. The active ingredient content of an emulsifier is the chief criterion of its efficiency.	☐	☐
7. Variations in toxicant, solvent and waters require adjustments in emulsifier blend for optimum performance.	☐	☐
8. The ratio of the emulsifiers in a matched pair need not be altered when the concentrate is used at high or low dilution rates.	☐	☐
9. In general, it is safer to formulate slightly higher on the nonionic side than on the anionic side when employing matched pairs.	☐	☐
10. Most formulators use the correct amount of emulsifier in their emulsifiable concentrates.	☐	☐

*Emulsifier Quality

ANSWERS

1. True. Most emulsifiers "salt out" in the presence of inorganic salts which impairs their function and breaks the emulsion.
2. False. Emcols H-A, H-B and H-C are used to emulsify insecticides in concentrated mixed fertilizer solutions in which the salt concentration may approach saturation. These emulsifiers have a unique tolerance to high salt concentrations.
3. False. Most efficient agricultural emulsifiers are blends of several anionic and nonionic surfactants.
4. True, if properly balanced with nonionic components. Conversely, the nonionic components of such an emulsifier impart improved performance in hard water.
5. False. It is not sufficient to balance the anionic-nonionic ratio. Since both anionic and nonionic components have hydrophilic and lipophilic properties, each in turn must be properly balanced to obtain maximum efficiency at the minimum use level. This requires blending several components, in some cases as many as 12 different surfactants.
6. False. The composition of the separate components and their balance is the prime consideration.
7. True. This is achieved most conveniently by the use of matched pairs of emulsifiers.
8. False. The rate of dilution required by the particular field application affects the blend of the matched pair necessary for optimum performance.
9. True. An excess of nonionic may result in excessive creaming which can easily be redispersed, but an excess of anionic may result in a tendency toward oil separation.
10. Only you can answer this. If you are using Emcols, you are saving money because they can be used at low use levels and give outstanding aging stability. Low moisture content, the rigidly controlled components, and Emcol know-how allow you to manufacture superior concentrates at competitive prices.

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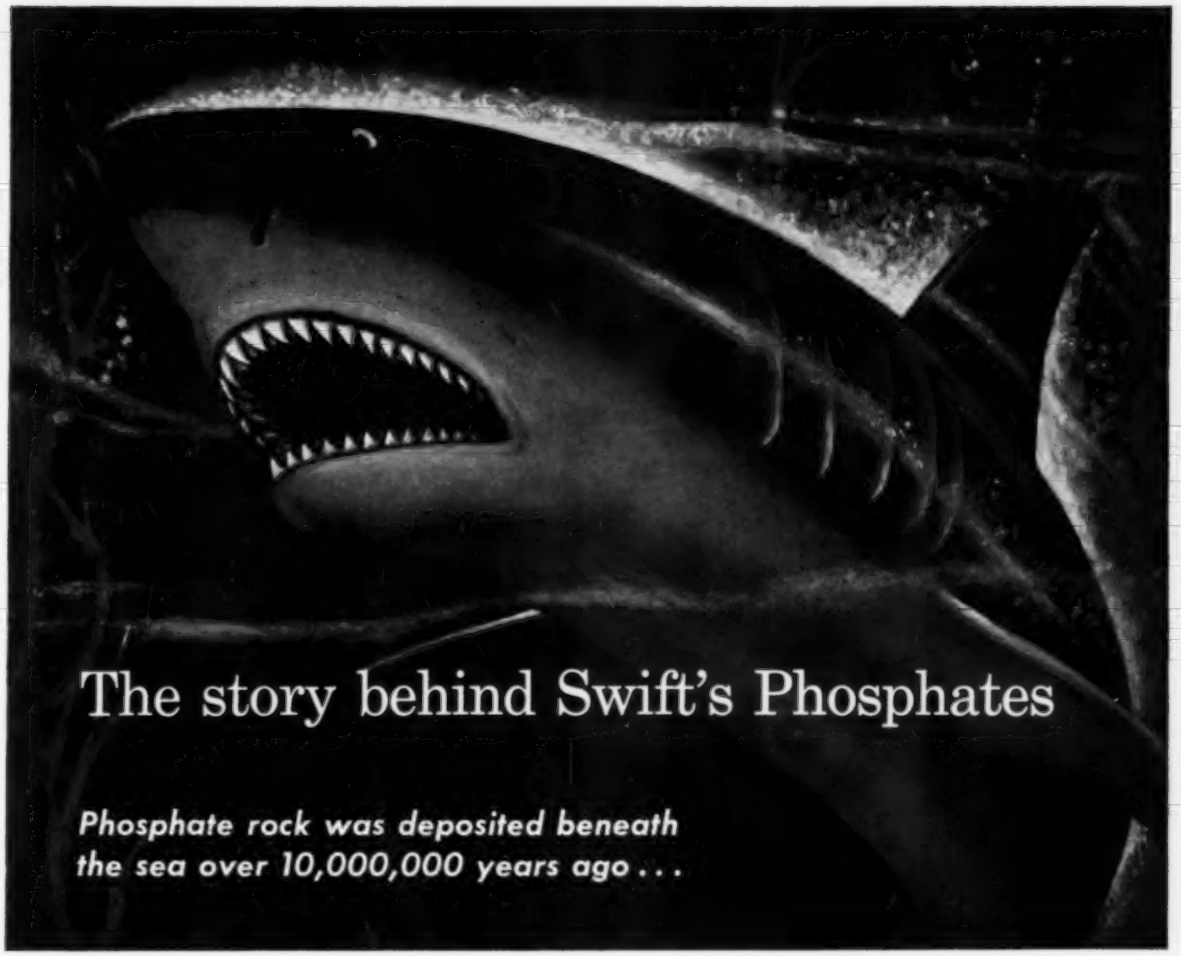

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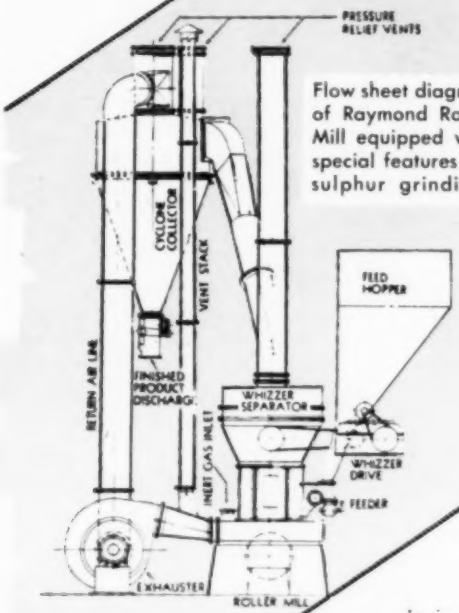
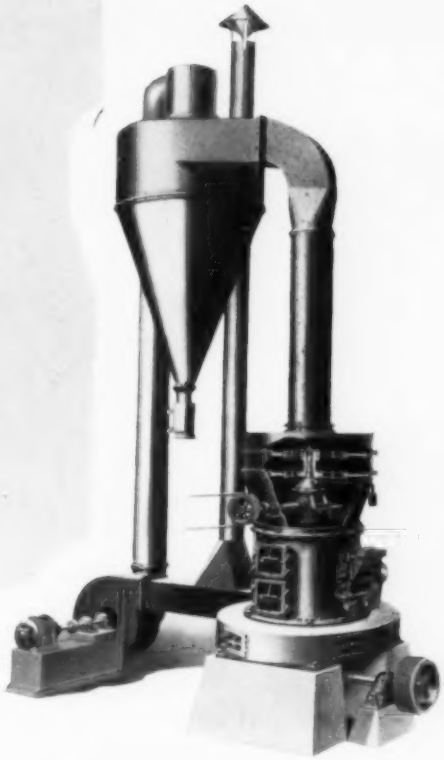


Flow sheet diagram of Raymond Roller Mill equipped with special features for sulphur grinding.



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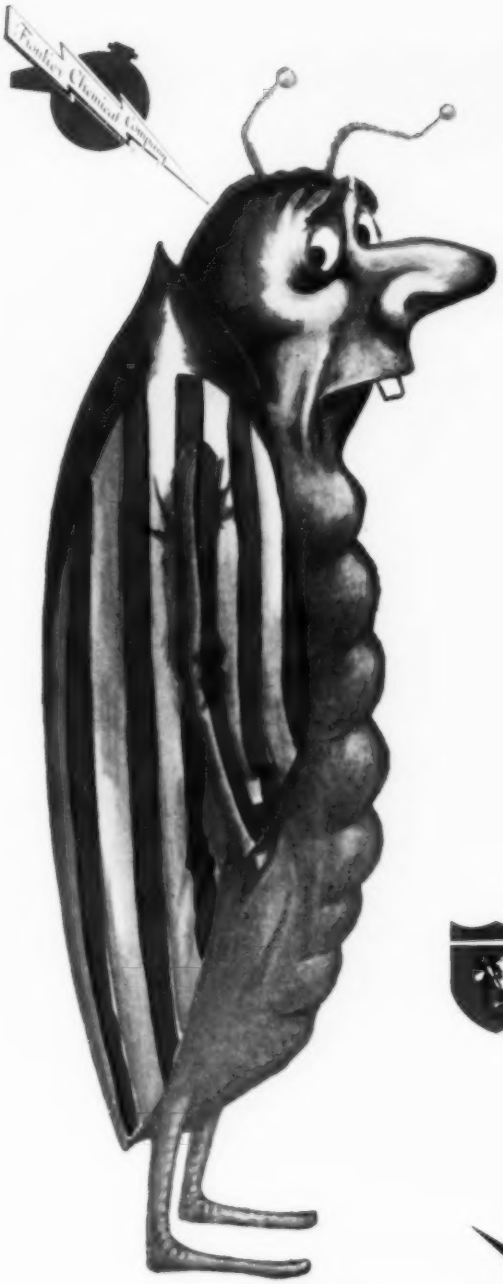

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in switch to Michigan Tractor Shovels

By equipping standard 16 cu ft Tractor Shovels with ¼ yd buckets, Growers Fertilizer Co-operative, Lake Alfred, Florida, has cut handling costs 15 per cent.

Growers' problem had been a common one . . . how to put greater efficiency into a system where weighing, mixing, and truck loading all were completely automatic. Only in such Tractor Shovel operations as unloading box cars, storing material, and feeding hoppers could there be much improvement.

With this limitation, plant manager Ed Shores' first thought was to get bigger machines. It was about time to trade in his four old 15 cu ft Tractor Shovels anyhow. But an increase of even one size *range* would keep the Tractor Shovels from readily passing through aisles, box car doors, and among some of the 38 bins (which ranged from 40 to 500 tons in capacity).

Then, a different *make* of Tractor Shovel came to mind. This machine—a 16 cubic ft power shift-torque converter Michigan Model 12B—would help boost production simply by preventing the end-of-shift fatigue that comes from constant clutching and declutching. Too, its extra cubic foot of capacity could up production—though only another 100 lbs or so per load.

That's when the key idea was born. Fertilizer is, after all, a relatively light material—the heaviest Growers Co-op handles weighs 110 lbs per cu ft. Perhaps the Michigan Model 12B could swing a bigger bucket, thought Mr. Shores. How about the standard Clark-built ¼ yarder? Fully heaped, it would carry 2230 lbs—470 lbs (27%) more than could the 16 ft bucket. Yet, its load would be well under rig's lift-and-carry capacity of 3,000 lbs. And its extra width, 4 inches, would cause no maneuverability problems.

A three-day on-the-job trial resulted. Michigan and the ¼ yd bucket performed "with highest honors." Loads weighed out at 2200 lbs or better. Each 40 ton box car was unloaded in about 1½ hours. Feeding the hopper from a stockpile 40 feet away, the 12B delivered 77 tons of fertilizer per 50-minute hour. With the fatigue factor reduced, operator made more runs in a day.

Result . . . the Co-op ordered three new Michigans to replace the four old machines.

Today, the combination of eliminating one Tractor Shovel and getting more production from each machine has provided the company with an over-all cost saving of 15 per cent! Yearly output, with only 12 men, is up to 100,000 tons, 700 grades of fertilizer, per season.

Perhaps the Model 12B Michigan can give you similar economies. Test one in your plant for proof—using the size bucket, 6 to 27 cubic ft, which best fits your material, job conditions, and production needs. Write us to arrange the details.

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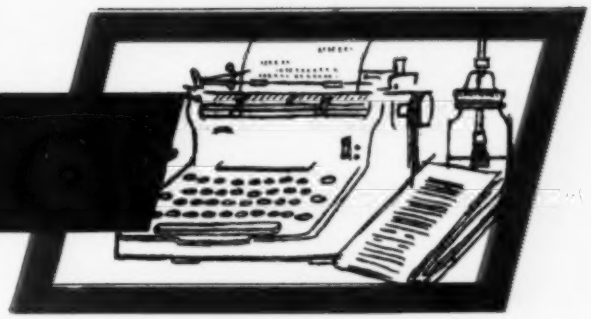
CYANAMID

PHOSPHATE INSECTICIDES

EDITORIALS



THE insecticide industry has another opportunity at the North American Wildlife Conference and at the convention of the National Wildlife Federation to get its story across to the public on the need for effective pest control, on an area wide basis. Those who speak for the entomological and the pesticide industry have a strong case to present, for pest control has made an outstanding record in safeguarding our natural resources, our crops, as well as public health and personal comfort. A full and fair airing of the facts should convince all who hear the proceedings with an open mind that projects such as the spruce bud worm spray program, the Florida Medfly campaign and the fire ant control program were, on balance, a tremendous success. The good they accomplished far counterbalanced any minor and purely temporary unfavorable side effects.

The pesticide industry, unfortunately for itself and for the public as well, has generally had a poor press,—as we have pointed out several times in these pages in the past,—the result to be anticipated from lack of an adequate public relations program. The problem has been compounded by the fact that pesticide applicators, too, ignore almost completely the importance of presenting their best face to the public. Nor has the USDA, who plans the spray programs, done much to fill the gap. Instead of stating their case to the public in advance of these spray projects, and influencing public opinion favorably, they have waited for complaints to mount, and then attempted to answer them.

It is an old and well established tactical principle that the soundest defense is a strong attack. This applies to defense against our insect enemies; and it applies just as logically to defending the idea of effective pest control against the highly vocal group of critics who would abridge its use.

For the future we would suggest to pesticide manufacturers and formulators, applicators and government supervisors as well, that they should not wait for attacks, but should rather carry their sound case aggressively to the public.

THE word from Washington is that the Senate Committee of the Judiciary Subcommittee on Antitrust and Monopoly may shortly turn its attention to fertilizer prices, along with a study of prices of aluminum, rubber tires, and paper boxes. Senator Kefauver will be back in his favorite role of defender of the farmer, breaking lances with the "tycoons" who at least in the senator's mind arbitrarily control prices of essential commodities, moving them up and down at their own whim, oblivious to normal competitive influences.

It is not enough for a successful politician, to be for home and mother; he must always be against something too—and sin and price fixing are favorite antagonists. The "fertilizer trust" has long been a popular target with those who seek votes in the rural areas.

We predict that this current investigation, if it materializes, will turn up very little to damage the reputation of the fertilizer industry in the public eye. There just is no case to be investigated, for fertilizer is one of the greatest bargains the farmer buys. Fertilizer prices in terms of plant food have risen only 10% since 1939, while the price of everything else the farmer buys has risen much more proportionately. Farm production items, for example, have increased by more than 100% since 1939, —

(*Continued on Page* 118)

CAKING of Mixed Fertilizer AND

IT is well known that fertilizers made by mixing ground raw materials may cake under certain conditions, resulting in relatively hard blocks or lumps of material. When this occurs in bagged fertilizers, complaints can of course be anticipated; the farmer has to grind his fertilizer in order to use it, or return it to the factory for remilling.

The causes of caking are discussed in the literature (1-3-4-7-8-10-11). Mitchell (7) observed the formation of needle crystals of NH_4Cl and of calcium sulphate in mixture made of $(NH_4)_2SO_4$, KCl and superphosphate. In this mixture, NH_4Cl is responsible for the caking.

Other authors have suggested that the formation of calcium sulphate from the reaction between superphosphate and ammonium sulphate is a main cause of caking of mixtures. This hypothesis is found in most books, but presently the opinion most widely accepted is that NH_4Cl is largely responsible for the caking of many mixed fertilizers. (5). With granulated fertilizers, the problem of caking is eliminated, but in Brazil, only powdered fertilizers are produced currently and the problem of their caking is quite important.

Quimbrasil S/A produces 4 grades (below) in largest quantities:

	1 (4-15-6)	2 (2-16-4)	3 (5-18-9)	4 (9-14-9)
Ammonium sulphate	400	200	500	900
Potassium chloride	200	140	300	300
Limestone		160		
Superphosphate	1400	1500	260	
Triple				200
Phosphate rock			940	600

Composition is in pounds per 2000-lb. ton.

The mixture is prepared in a rotary drum followed by storage in wooden bins 100-200 2000-lb. tons capacity. After 40 or more days, the fertilizer is blasted from the bin, ground and bagged. The No. 1 formula, compounded only with superphosphate, potassium chloride and ammonium sulphate, cakes much more than the others. This formula undergoes a noticeable increase in volume on curing, which may even break bins not constructed to withstand this extra pressure. The temperature in the material increases up to 40°C. A 40-day curing period was adopted tentatively without any experimental basis.

Determination of the optimum curing period is of practical interest; longer curing time requires more storage space, need of better knowledge of the sale possibilities of the different formulas, etc., while an insufficient curing period might magnify future caking problems. According to Sauchelli, (9) as well as our own experience, fertilizer once caked and ground, does not cake again with similar intensity. We have studied the factors affecting the time needed for *complete caking* of our fertilizers. At first we had to determine the complete curing time, which we define as the shortest curing time after which there is minimum re-caking of the ground fertilizer. The determination was made in the laboratory according to the following procedure:

A well mixed sample, screened (10 mesh), is packed in a small paper bag and kept in an oven, at 35°C, and 7 p.s.i. pressure. To obtain the pressure which the fertilizer undergoes normally in bulk storage we constructed the simple device shown in Fig. 1. Every week one sample from this "bulk curing" was crushed, screened (20 mesh) and tested with the apparatus shown in Fig. 2. To form the sample cake for the "crushing test", 20 grams of the fertilizer were poured into the stainless steel tubing (assembled with the two rings). One felt wiping disc was placed below the material and another above it. The pressure on the fertilizer was applied through the iron piston, which, with the three weights, produces a pressure of about 7 p.s.i. (excluding one or more of the weights, it is possible to apply a smaller pressure). The assembled apparatus (Fig. 2-A) was kept at 35°C in the oven for a week.

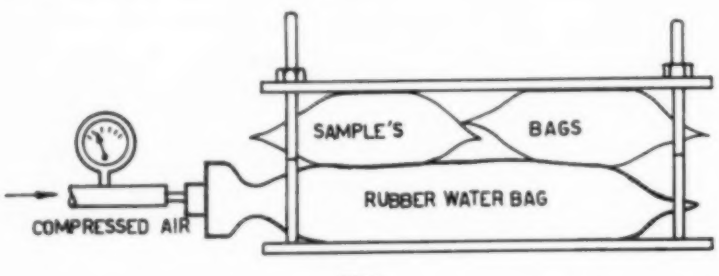


FIG. 1

Figure 1:—Apparatus for applying pressure on fertilizer samples. The sample's bags are compressed between the rubber bag and the iron plate fixed with four screws to the base plate. The pressure applied on the samples is determined by the pressure of the air in the rubber bag.

First installment of a 2-part report

its ALLEVIATION

by Semon Kuczynski

Quimbrasil S/A. —
São Paulo — Brazil

The formed cake was extracted, after removing the head piston and opening the two halves of the stainless steel tube. (Fig. 2-B). This apparatus is similar to the one described in the literature (10). To determine the "crushing strength", the sample cake is subjected to progressive pressure in the apparatus shown in Fig. 2-C, until it breaks. The results are given in Table I. The complete curing time, determined by these tests, appears to lie between 3 and 4 weeks; much less than the time formerly used in our plant. The formula 1 caked much more than any other. We based all our work on this formula, but believe that the results may be applied to the three other formulas or to any similar fertilizer made with the same raw materials.

Superphosphate

SUPERPHOSPHATE is normally pile cured before use in mixed fertilizer. Is this curing necessary or convenient? And does the free acid and the humidity of the uncured superphosphate influence curing time? We found, through the above described procedure, that use of uncured superphosphate is advantageous. We could not reduce curing time with fresh superphosphate, but curing was more regular and reliable. The results are shown in Table II. Probably the fresh phosphate furnishes more liquid phase, which facilitates the curing reaction. The variable results obtained with the cured super could be explained by initial lack of curing during the first and second stages of our caking test. This interpretation finds support in the results obtained in the next tests. Three samples of No. 1 formula were prepared, one with superphosphate, another with superphosphate vacuum dried, and a third with water added. The results are

(Continued on Page 118)

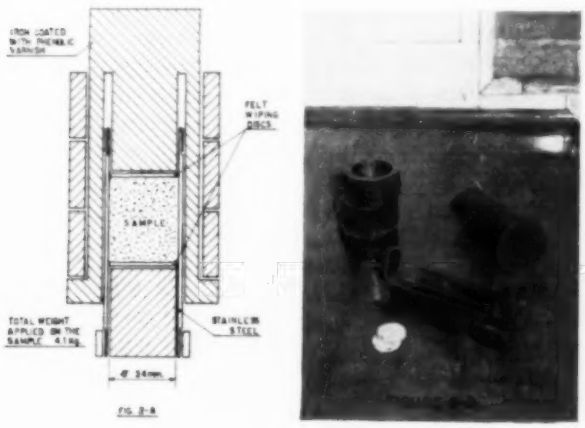


FIG. 2-B

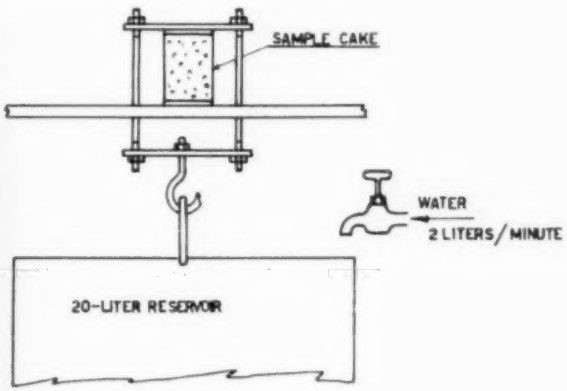


FIG. 2-C

Table I. Caking Tendency of a Mixed Fertilizer During its Cure.

No. 1 Formula: (4-15-6): Ammonium Sulfate 20% — Potassium Chloride 10% — Superphosphate 70%.

Bulk Curing	Crushing Strength
0	43,7
1 week	24,8-24,0
2 week	11,8-13,5
3 week	6,1-8,1
4 week	6,6-8,1

Table II. How the Caking Tendency of a Fertilizer is Affected by the Superphosphate's Age.

No. 1 Formula: (4-15-6): Ammonium Sulfate 20% — Potassium Chloride 10% — Superphosphate 70%.

Bulk Curing	Crushing Strength (PSI) Using Fresh Superphosphate	Using Cured Superphosphate
1 week	13,5	7,2
2 week	7,8	11,4
3 week	4,9	4,2
4 week	2,3	3,8

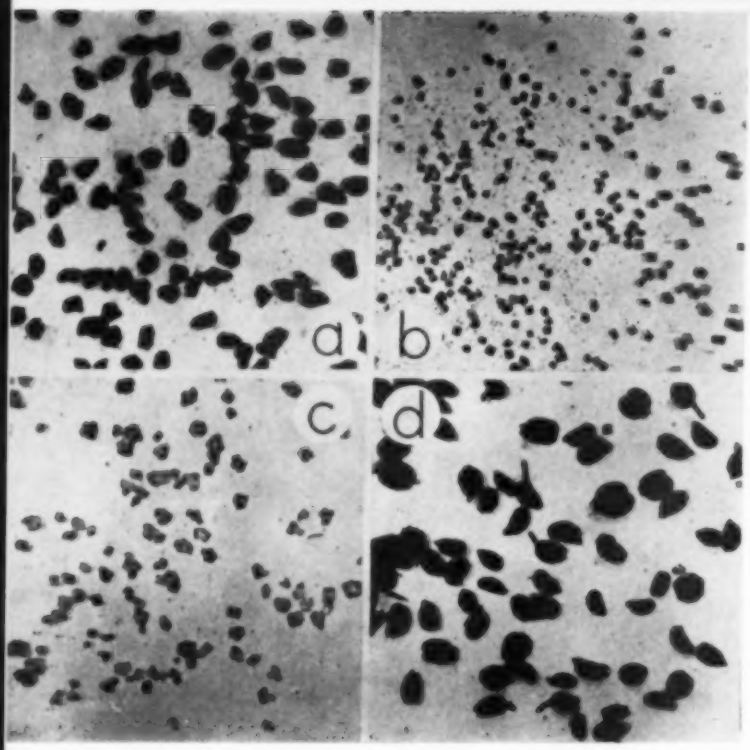


Figure 1.—Granulated dieldrin (a), with table salt (b), granulated sugar (c) and celery seed (d) for comparison of grain sizes.

PROGRESS IN GRANULATED INSECTICIDES

By E. Burgess

Entomology Research Division,
Agricultural Research Service,
U.S.D.A., Beltsville, Md.

INSECTICIDE preparations in the form of powders or particulate solids were formerly classified into two groups, (1) wettable or water-dispersible powders for use in sprays, and (2) dusts. There was overlapping, because many wettable powders are suitable for dusting. In the last eight or ten years there has been a growing interest in a third group, granules. They are applied in much the same way as dusts, but the two are direct opposites in their essential characteristics. With a dust, the objective is to give as general and thorough coverage as possible to all surfaces with which the insecticide comes in contact; therefore, the particle size is made extremely small, and the specifications may prohibit any more than a trace of material coarser than 250, 177, or even 149 microns (U.S. standard sieve Nos. 60, 80, and 100, respectively.

With granules, on the other hand, the objective is for the insecticide to fall through or over any intervening covers or barriers of vegetation without clinging to them; very fine particles are not only unnecessary, but objectionable. The advantage of the granular type is in its relative freedom from dust, and although some dust is always present, what there is may be regarded as a physical impurity, whatever its chemical composition.

The particle-size characteristics of granulated insecticides may be visualized through reference to Figure 1, wherein an inescticide is pictured alongside familiar household commodities of the same order of fineness. Quadrant (a) is a granulated 10% dieldrin of top physical quality, (b) is a well-known brand of table salt, (c) is a familiar brand of granulated cane sugar, and (d) is whole celery seed. (Note that some of the seeds are in the original pairs, but many of the pairs have become divided.) It is obvious that the insecticide preparation is somewhat coarser than the salt and the sugar, but finer than the celery seed.

The comparison is carried further in Figure 2, where the dry-sieve analyses of the same four samples are presented. Each of the materials is seen to be mainly in the size range between a quarter and a whole millimeter.

The attainment of the desired granular characteristics for a formulation lies primarily in the choice of carrier, for the insecticide itself may have no granular character; it may not even be a solid. The usual practice in manufacture is to impregnate sized granules of a clay or other porous solid material with a solution of the insecticide; sometimes the active ingredient is rendered sufficiently fluid in heat to make possible the omission of the solvent. An insecticide that does not lend itself to solution or liquefaction may be mixed with a water-moistened clay before the clay is formed into granules. The concentration of active ingredient in granulated products is commonly from 2 to 25% by weight, 5 and 10% being the most prevalent. Occasionally, two insecticides are combined in a single formulation.

The insecticides that have been incorporated in granulated formulations include aldrin, BHC, chlordane, cryolite, DDT, dieldrin,

*Revision of a paper read at the fourth annual Pacific Northwest Agricultural Chemicals Industry Conference, Portland, Oregon, January 24, 1957.

endrin, guthion, heptachlor, malathion, rotenone, TDE, thimet, and toxaphene. Certain others have been advertised as available on special order, and presumably almost any insecticide would be obtainable in this form if the demand arose.

Insects against which granular formulations have given success or promising indications include such widely diverse types as ants, boll weevil, chinch bug, corn rootworms, cutworms, European corn borer, Japanese beetle, leaf miners, Mediterranean fruit fly, mosquitoes, sand flies, sugarcane beetle, thrips, white-fringed beetles, and wireworms.

Outstanding areas of successful experience with granules are in the control of several species of mosquitoes, the European corn borer, and white-fringed beetles. The white-fringed beetle work involves a control program in which Federal, State, local and business agencies participate, all through the Southeast from Louisiana to North Carolina, with some activity beyond these limits.

In mosquito control, the peculiar usefulness of granules consists in their ability to sift through overlaying vegetation into the watery habitat of the larvae, and there to disintegrate and allow the toxicant to be dispersed. The advantages against white-fringed beetles are similar; lawns, vacant lots, and weed- or brush-covered grounds can be treated with little hazard of drift, and the granules fall readily to the soil surface, there to be broken up by weathering.

From the foregoing it might be inferred that the use of granules in crop protection would be confined to soil treatments. For the most part this is probably true; the control of the corn borer, however, provides an interesting variation. Many of the granules striking the corn blades are channeled into the whorls and leaf axils, the strategic sites for contacting the feeding borers, but very little of the insecticide clings to the leaf surfaces away from these localities, thus simplifying the residue problem.

In some situations, as in soil treatment against wireworms in potato land, the superiority of granules over fine powders is not in the actual effectiveness, but only in the cleanness and convenience of handling and distribution, which are in themselves important considerations.

Concurrent with the last six years' experimental and field use has been a gradual development of product-quality standards. Such standards normally start out with a rather informal, not to say crude, delineation called a purchase description, which may be used from time to time in purchase contracts. As experience is accumulated, the description is revised and refined, and in the course of time, it may reach the status of an Interim Federal Specification, and eventually an adopted Federal Specification. If it reaches this last stage, then its use is mandatory for purchases made by agencies of the Federal Government, but not for anyone else. Even so, adoption by the Government for its own procurement may set a pattern for the industry; in fact, industrial representatives always participate in the development of the specifications. Two Interim Federal Specifications for granulated insecticides have been issued: 0-I-00525 for dieldrin, and 0-I-00528 for heptachlor; and one for chlordane has been proposed.

The laboratory studies directed toward establishment of granulated-insecticide specifications have been associated closely with the control operations against white-fringed beetles, the Mediterranean fruit fly, and the imported fire ant. The principal concern of the control programs is not experimentation, but to down the pests without delay, and hold them down. Consequently, the specifications had to be confined to products readily standardized. The narrow standards that have resulted are not meant to discourage future research on other types of carriers, other grain-size distributions, and other features in general than those accepted at present for control programs.

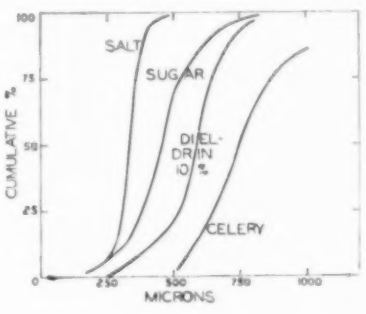
Notation will here be made of some milestones that have been passed in the development of standards, and some questions for which we still have to find the answers. Besides the chemical requirements as to content of active ingredient, there are the following considerations:

(1) *Carrier.* One of the most familiar carriers is attapulgite. This clay mineral is available in four forms of processing: it may be extruded or not, and in either case it may be either calcined or merely heated enought to dry it thoroughly– that is, to drive out the uncombined water. The extrusion reorients the fibrous microscopic particles in such a way as to increase absorbency; calcination also increases absorptive capacity but retards disintegration of the granules. Therefore, the preferred combination is extruded and uncalcined. Attapulgite in this form is the choice in many places for nonexperimental work. Research is in progress, however, in both public and private agencies, to evaluate other types of granular materials, mineral and vegetable, as carriers.

(2) *Solvent.* Considerable advance has been made in specification of the solvent. At first, the purchase descriptions were vague.

(*Continued on Page* 115)

Figure 2.—Dry-sieve size distributions of materials pictured in Figure 1.



Top photo: West end of plant. Canopy protects entire length of truck loading dock, while leanto covers rail spurs. Office wing is at left, connected by covered walk to loading platform.

Photo at right: Sides of storage bins are formed by 15-foot 2 x 8 planks, separated by spacer blocks.

AN economical plant for producing ten different grades of granulated chemical fertilizers for Maine farmers has been put into operation by Eastern States Farmers Exchange, Inc. Designed, fabricated and erected for Eastern States by Luria Engineering Company, of New York and Bethlehem, Pa., the new plant is centrally located in Maine on U. S. Route 100 near Detroit. The location facilitates bulk pickup by growers as well as rail delivery. Output scheduled for the first year is 15,000 tons; thereafter, the plant will produce from 25,000 to 30,000 tons per year, depending on demand.

Approximately one-half of the total output of the new plant will be in special grades of fertilizers for potato growing. These include granular 8-12-12 and 10-10-10, both with soluble magnesium. Low chlorine variations of these grades are also manufactured for producing a high quality potato. Additional granular formulations include 15-10-10 for grass, corn and orchards, 10-10-10 for grass and corn, 8-16-16 for potatoes and cover crop in rotation and for general crops, 0-25-25 for legumes, and 0-15-30, with borax, for legumes. Pulverized 5-10-10 for general crops is also produced. All are available in bulk or in 80-pound paper bags.

Convenience for the farmer-customer was a paramount consideration in designing the structure. A long shipping platform, under canopy, extends the entire 145-foot length of the west end of the building, adjacent to the plant office. A short covered walkway connects the office and loading dock. This arrangement eliminates delays and makes the product available at lowest cost, — for the farmer can come in with his own truck, immediately take bulk delivery, save freight and get discount for tonnage. Rail shipment can also be made from covered spur tracks along the south side of the plant.

Eastern States Farmers Exchange, Inc. — a cooperative purchasing organization — has prospered and grown through offering farmers economies of this sort. Founded 40 years ago, Eastern States now operates five fertilizer plants, two general farm supply plants, two large feed mills and 101 supply stores, to serve its members in the six New England states, Pennsylvania, Delaware and Maryland. The other fertilizer plants are located at Cambridge, Mass., Wilmington, Del., York and Kittanning, Pa. Operation of all Eastern States plants and stores is supervised from headquarters in East Springfield, Mass.

The new unit for producing, storing and distributing fertilizer in Maine is 300 feet long by 145 feet wide, with corrugated asbestos roof and siding. Its length parallels the highway, which lies approximately 600 feet to the north. At the northwest corner of the plant is a wing, 100 x 30 feet, for offices, lockers and plant maintenance shop.

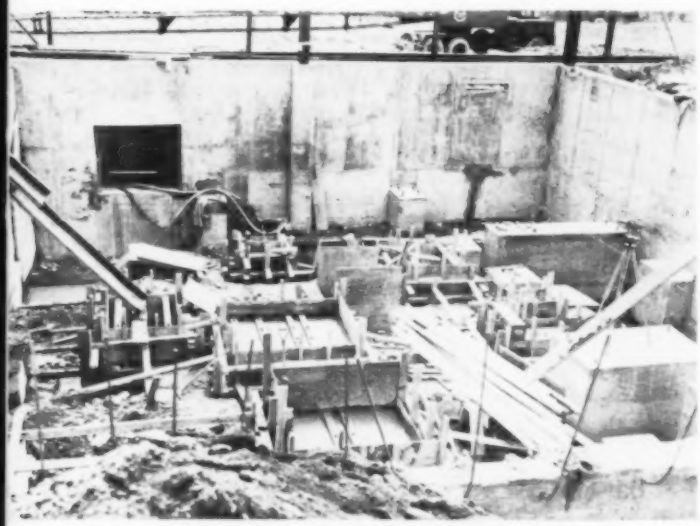
The building foundation, in-

cluding pit and tunnel for automatic unloading of raw materials, is of concrete. Preparation of the site required a 12-foot cut running east and west, about 500 feet from the highway, making a knoll that required conventional earth moving, grading and leveling. Drainage from the knoll is gathered by a surrounding trough which empties, through culverts under the tracks, into an artificial pond south of the sidings.

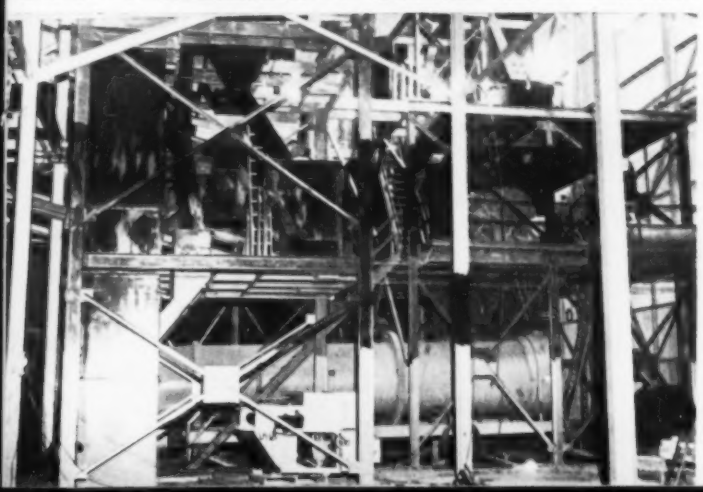
Raw materials arrive in hopper cars on spur sidings from the Maine Central Railroad, which are covered by a leanto for protection from the weather along the south side of the plant. The leanto affords cover to as many as eight cars at one time.

The raw materials are unloaded and handled automatically, the hopper cars discharging their contents into chutes between the rails. Underground, a horizontal belt conveyor carries the material some 40 feet to a pit below the production area. From there it is lifted by vertical bucket elevator to the storage area 55 feet above. A shuttle and reversible type conveyor moves it along a 48-foot route to one of the eight storage hoppers, each of approximately 20-ton capacity, where the material is held until needed for processing.

Automatic handling of ingredients speeds output by eliminating tedious manual labor and plays a major role in efficient production at the new Eastern States plant. Belt conveyors, controlled by push button, move material at 200 feet per minute. Made by Stedman Foundry and Machine Company of Aurora, Indiana, the conveyors are fitted with anti-friction bearings, guide rolls, belts of 18-inch width and a new advance — return idlers of rubber. Unlike pulleys made from conventional materials, fertilizer or ingredients will not stick to these rubber spools.



Top photo: Construction view shows special concrete foundations for heavy production machinery and, at rear, opening in south wall for horizontal belt conveyor. Today, the conveyor brings in raw materials dumped from hopper cars into chutes between the track rails.



Lower photo: View of production area. In operation, mixers on top level at the right discharge material to the dryer directly beneath. Dried material then discharges to the cooler below. In left foreground is vertical enclosure for bucket elevator.

The mixing process is a partial batch and partial continuous system. Flow sequence starts with selection of the needed dry raw materials from storage. Predetermined amounts of each are weighed on scales under the storage hoppers, then discharged to a conveyor belt for transfer to a bucket elevator leg that lifts the batch 40 feet and dumps it onto a Hummer vibrating screen. Screened material flows into one of two batch mixers, each of 50 cubic foot capacity. One unit accepts and mixes a batch, while the other is discharging a completely mixed lot. The alternation permits mixing 20 to 25 tons hourly.

At this station, liquid constituents are added from a 10,000-gallon storage tank outside the east end of the building. Required amounts of ammonia (for nitrogen content), and sulfuric acid needed to form ammonium sulphate and produce desired heat to encourage granulation, are brought in through plastic pipe with stainless steel valves and fittings. Due to chemical reaction, batches leave the mixers at temperatures of 175° to 220°F. Both mixers discharge into a common chute that channels the hot mash or paste to the dryer, where granulation occurs. The dryer is 36 feet in length, 6 feet in diameter and of 25-ton capacity. It is a rotating, cylindrical, counter-current McDermott unit that dries the fertilizer to 1% moisture. Dried material leaves at 50° to 75° less than its entering temperatures and passes directly into a cooler of 25-ton capacity. The cooler, too, is a McDermott counter-current unit 6 feet in diameter, but 42 feet long. A fan drives air through the cooler at 16,000 cfm. Cooled material leaves at approximately room temperature, moves away on a short conveyor and is again lifted vertically by a bucket elevator to top elevation where it discharges onto a final classifying screen.

The finished product comes through the screen in granules of uniform size and shape. At this station, the fines are collected for

return to process, and the oversize particles go to a cage mill for reduction, then again to the screen. Accumulating below the classifier, the finished product is moved 85 feet across the area and simultaneously raised to a traveling bridge crane by a conveyor that climbs upward at a slope of 20°. The crane, of 2-ton capacity, travels on a rail installation atop stub columns for high safety factor. A 32-foot shuttle and reversible type conveyor on this crane distributes the fertilizers to the proper storage bins for each grade.

The entire north half of the plant is used for storage of the finished product. Each 20-foot bay along the north wall serves as a bin that extends to the plant center line. Adjacent bins have common sides, utilizing plant structural supports in the form of vertical H-beams on 15-foot centers, from wall to center line. Simply laying 15-foot 2 x 8 planks flat, retained in the H-beam flanges and separated with spacer blocks, makes a common open type side that allows expansion of the stored product.

Gasoline operated hydraulic tractor scoops are used to maneuver material in the bins, and to feed conveyors in the south half of the plant, which move bulk material to the rail and truck shipping docks. Anticipating wide demand for tonnage in paper bags Richardson Packers have been installed to provide rapid, automatic packaging. Fork lift trucks handle the job of moving pallets of bags for truck and rail delivery.

Approximately 50 electric motors are required to drive the machinery in this plant. They range from fractional horsepower up to the 40-horsepower units that operate the dryer and cooler. All are controlled from a central panel on the south wall near the production area. Electric current for the motors comes from a substation outside the north wall, where three transformers are served by overhead 440-volt mains that parallel the highway.

Excellent illumination is a feature of this Eastern States plant. Some 30 translucent panels of corrugated green plastic, each six by ten feet and appropriately positioned in roof and walls, contribute to a daylight-bright interior. Window glass in steel sash is used in the office wing. Electric lighting is, of course, also provided for dark days and night shifts. Comfortable temperatures are provided in office and locker areas by warm air heating. Space heaters provide warmth for shop and plant.★★

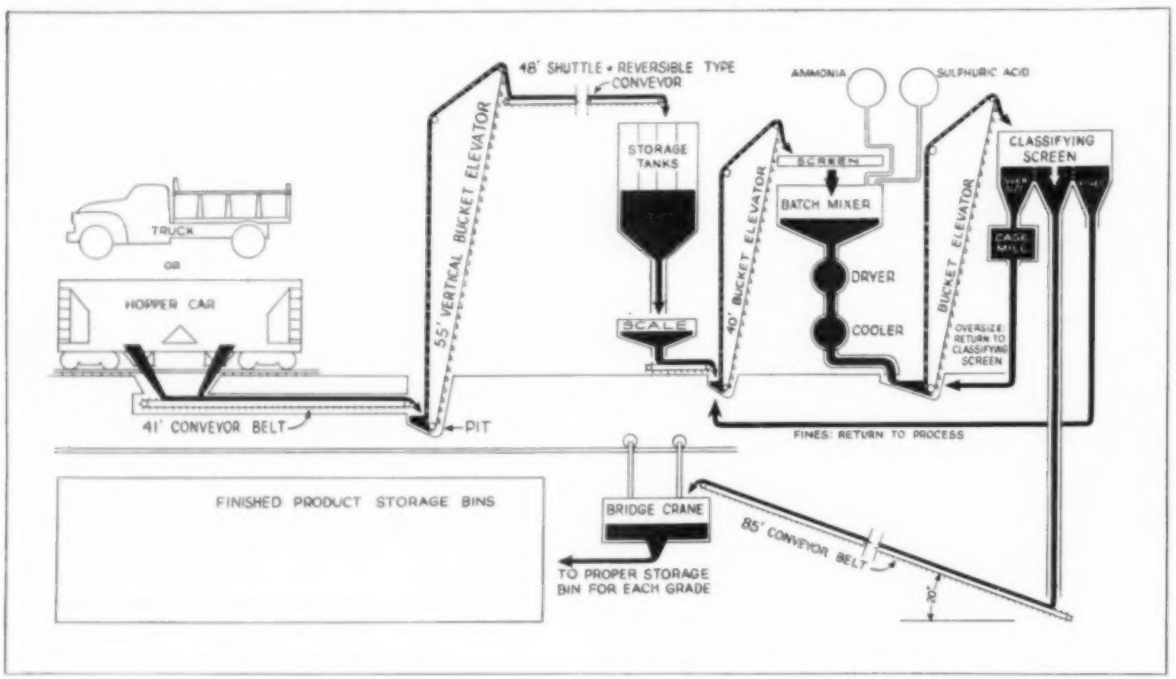
BOOK REVIEWS

Weed Control Handbook, issued by the British Weed Control Council. Published by Blackwell Scientific Publications, Oxford, England. 245.

The first in this annual series of reports was printed in 1953. In its present form, the book no longer confines itself to recommendations, but contains a wealth of information on most aspects of weed control. It lists weeds and their susceptibilities, crops and their resistance. Methods of application of herbicides are described and sections are devoted to such matters as spray drift and the legal aspects of herbicide use.

The Chemical Analysis of Foods and Food Products by *Morris B. Jacobs.* Published by D. Van Nostrand Co., Princeton, N. J. 970 pages, price $13.75.

A standard reference for food chemists, this third edition has been revised to include radiochemical determinations and pesticide residues. The book is written with American food legislation in view.



Co-operative Federal State

PLANT PEST CONTROL WORK

Highlights of 1958

*by E. C. Burgess**

GRASSHOPPER control on five million acres and completion of the Mediterranean fruit fly eradication program highlighted the cooperative Federal-State pest control accomplishments in 1958.

Several other important pests were also attacked under the organized pest control and eradication programs that supplement the work done by farmers on an individual basis.

The grasshopper outbreak was the worst since 1949. Colorado had the most serious infestation, and the treatment provided in the program — not counting cropland treated by farmers — covered more than 2 million acres of range, roadsides, and waste and idle land. Texas had 931,418 acres in the program, Kansas 210,636, Wyoming 302,822, and Oklahoma 242,538. Some land was treated in Arizona, Idaho, Montana, Nebraska, New Mexico, and South Dakota.

In the five states where grasshopper infestations were heaviest, over 130 vehicles and more than 100 airplanes were pressed into the battle to treat the vast area of infestation. Prompt action by the farmers and ranchers, and by the States and USDA, protected large acreages of small grains and row crops and prevented serious losses to vast acreages of grass.

Mediterranean Fruit Fly

Not a single Mediterranean fruit fly has been caught since November 26, 1957, although more than 30,000 traps have been used to detect the pest's presence in Florida citrus. From April to December 1956 the Medfly was found spread over 800,000 acres in 28 Florida counties. When the last plane carrying malathion bait spray made its run on February 25, 1958, an aggregate of nearly 7 million acres had been treated. This material, and the granular dieldrin used for soil treatment in some areas, spelled elimination for the Medfly, — the pest that threatened the Florida fruit and vegetable industries valued at $400 million annually. The intensive trapping program is being continued to safeguard this accomplishment.

Eradication of Hall Scale

Eradication of another destructive insect, Hall scale, is also indicated by mounting evidence. Survey work during the year revealed no infestations of this imported insect pest of stone fruits, particularly peaches and almonds. No scale has been found since 1956 in the California counties (Butte and Yolo) where it had entrenched itself. From the time the cooperative Federal-State eradication program against this pest began in 1942, close to a million host plants have been inspected, and about 49,000 infested plants or plants exposed to infestation have been fumigated under gastight plastic tents with hydrocyanic acid gas. More than 17,000 host plants have been removed and burned to destroy any scale present.

- **USDA efforts to control Mormon cricket have prevented spread of this pest.**
- **Mounting evidence points to successful eradication of Hall scale.**
- **DDT-Sulfur, DDT-Guthion, are among pesticides used in control program against pink bollworm.**
- **Areas treated for Gypsy Moth eradication are yielding either no moths, — or very few.**

Mormon Cricket Problem

Timely control efforts over the past several years have prevented Mormon crickets from reaching outbreak proportions. It was necessary to treat only 73,203 acres in 5 Western States in 1958 to control all known Mormon cricket infestations. The acreages by states were as follows: Nevada 38,104; Utah 26,258; Montana 7,255; Idaho 1,560; Wyoming 26. These areas

* Director, Plant Pest Control Division, Agricultural Research Services, USDA.

were treated with a bait made with rolled wheat impregnated with aldrin. Since USDA began a program several years ago to prevent the buildup and spread of this insect, no large bands of Mormon crickets have formed. The areas needing treatment have become smaller and smaller over the years.

These experiences in plant pest eradication programs strengthen the belief that those now under way can be carried out to successful conclusion.

Gypsy Moth Eradication

Particularly encouraging are the trapping results for the gypsy moth in the Northeast. In northeastern Pennsylvania, where about a half-million acres of forests were treated with DDT in 1958, no moths were thereafter captured in a 7-million-acre area, where some 13,000 traps were used in the survey. The gypsy moth is apparently at an unprecedented low level, and the areas treated for eradication are yielding either no moths or, in control areas, very few. Only two catches were made in the 3 million acres treated in New York in 1957 and a single catch in the area treated in New Jersey.

Imported Fire Ant Program

The imported fire ant program proceeded as planned with more than 500,000 acres treated in relatively small, scattered areas in the nine fire ant-infested Southern States. Nearly three-fourths of the treatment has been conducted under the Federal-State-local organization – the remainder by farmers independently. Granular heptachlor or dieldrin at 2 pounds per acre is applied by hand, by motorized ground equipment, or by aircraft.

The eradication plan calls for treating outlying infestations to prevent further spread of the ant. Already over 60 of these infestations have been treated in their entirety. All known infestations in North Carolina have been treated and the known infestations in Arkansas and South Carolina are under treatment. By the end of the year it is planned that the northern boundary of the generally infested area will have been pushed back to a line running east and west through the centers of Alabama and Mississippi. Although progress is being made against this pest, the job has just started since infestations are scattered over nearly 22 million acres.

The Khapra Beetle

Against the khapra beetle, fast-multiplying pest of stored grain, marked progress was made during the year. However, several years of inspection, reinspection, and fumigation of any newly-discovered infestations will be needed to eliminate this elusive and hardy pest from Arizona, California, New Mexico, and the Republic of Mexico. Infestations treated recently were mostly in small retail stores and farm storage buildings, although some were in commercial elevators. The treatment used is fumigation with methyl bromide gas which requires that the storage building be completely wrapped in gastight tarpaulins.

Pink Bollworm

The pink bollworm on cotton has become increasingly damaging in central Texas during the past several years. Serious breakouts to the west in Arizona and to the east in Arkansas and Louisiana have occurred in crop year 1958. Currently, two new counties—Maricopa and Pinal – have been added to the regulated area in Arizona. Six additional counties have been reported as being infested in Arkansas – including Clay in the extreme northeast corner and Ashley and Drew in the southeastern part of the State within 35 miles of the Mississippi River. Some four new infested parishes have been reported in Louisiana. In Arizona, a vigorous start has been made to eradicate the new outbreak. The complete situation in Arkansas and Louisiana will not be known until the close of the inspection season although an aggressive eradication program is under way in the newly-infested counties.

The program in Arizona includes the cultural practices of mandatory plant residue destruction by specified date set by the state and the use of insecticides. Materials being used are DDT-sulfur applied as a dust, and a combination of DDT and Guthion as a spray. Sevin, a new insecticide, may be used on the 1959 crop if field trials in 1958 bear out results of research tests. Also, in 1959, growth of stub cotton will be prohibited by state regulation and a specified planting period will be established.

Witchweed Eradication

A 3-million dollar program aimed at eradication of the witchweed is presently under way in North Carolina and South Carolina. Both cultural practices and 2,4-D herbicide are being used. The program was started on a limited scale in the spring of 1958 on 1,000 acres of cultivated land and 4,000 acres of noncultivated land. It is now being expanded to include all the known infested acreage – about 75,000 acres of cultivated land and 20,000 of noncultivated land in 12 counties of North Carolina and 6 counties of South Carolina. The parasitic plant was first discovered in 1956—apparently imported from South Africa where it is a serious pest.

It is believed that witchweed can be eradicated by growing crops that will cause its seeds to germinate, followed by the destruction of parasite and host by plowing under before new witchweed seed is produced, or by using a herbicide to destroy the witchweed plants before they form seed. Principal host crops of witchweed are corn, sorghum, and sugarcane, but it attacks more than 60 species of the grass family, including rice, wheat, oats, and barley.

Witchweed should be eliminated while it is confined to a relatively small area to keep it from

(*Continued on Page* 111)

New Business Opportunity for Distributors of Liquid Fertilizer

By Barney Frankl
Mor-Gro, Inc.
Algona, Iowa

AS a medium-sized fertilizer company located in Northcentral Iowa, Mor-Gro, Inc. had developed a sizeable business over the past eight years distributing anhydrous ammonia in addition to some dry fertilizer. With this type of business, however, about 90 per cent of our activity is concentrated in a two-month period, after which activity slows down considerably until the next season.

This led to our entering the liquid feed field in recent years to diversify our business and extend our operations over the full 12 months of the year. We have found liquid feeds to be an excellent partner to a liquid fertilizer operation.

The feed we handle is "Morea"* liquid supplement. The product is sold to mixer-distributors as Morea premix concentrate. The mixer-distributors blend the premix with cane molasses and the finished product then is delivered to farms or feedlots by tank truck.

Our company was in an ideal position to enter this new field because our existing plant and trucks could be converted to handle liquid feed. A good many of our liquid fertilizer customers are cattle and sheep raisers and, because of the seasonal nature of our business, we had a sales staff available to make the necessary direct contacts with farm customers.

From our salesmen's standpoint, liquid feed has advantages which appeal to farmers. It is easy to handle, it is delivered in bulk by tank truck, and it brings automation to the feedlot.

Presently, we have three tanks at our liquid feed plant. A 40,000 gallon tank holds molasses and a 12,000 gallon tank holds the premix concentrate. The third tank, also of 12,000 gallons capacity, holds the finished supplement ready for shipment by tank truck.

In most instances, finished Morea feed as sold to the farmer can be handled with the same equipment that is used to handle liquid fertilizer, without any corrosion problems.

For bulk delivery right to the feedlot, we have four trucks that carry a six-ton load and a large tank truck that can haul 15 tons or more. With this equipment, we can do all our own hauling of the molasses. However, we are located on rail lines and can take shipments of molasses or make shipments of the feed supplement by rail tank car if necessary. Presently, our sales are concentrated in about ten counties in Iowa, within a radius of 100 miles from our plant.

Our present plant is more elaborate than plants for most feed blending stations around the country. Equipment includes mechanical mixers and agitators. If we were to build another plant, I think that a less elaborate setup would be just as satisfactory. We would install a large storage tank of at least 16,000 gallon capacity with a suitable gear pump and electric motor. With this, we could blend the premix and molasses by recirculation. As volume increased, we could simply add more tanks and use the same pump and equipment. This is possible because the finished suppplement is stable and does not separate. For economy in delivery, we believe it would be best if the sales area were concentrated within 35 to 40 miles from the mixing plant.

From initial sales, our business grew rapidly. We operate on a fiscal year ending July 31. The volume for the first year was approximately 600 tons of finished supplement. By 1958, volume was up to 2,500 tons and this year we are selling three times as much as we were a year ago. If we maintain this rate, as we expect to do, we will reach 1,000 tons per month and go over 8,000 tons this year.

A main factor that accounts for this growth is the direct sales and service we provide. We have three or four salesmen going directly to reputation feeders in our area selling an economical and easy-to-handle product. We help the farmer plan a liquid feed program, set up the storage tank feeder units and provide regular checkups on his progress.

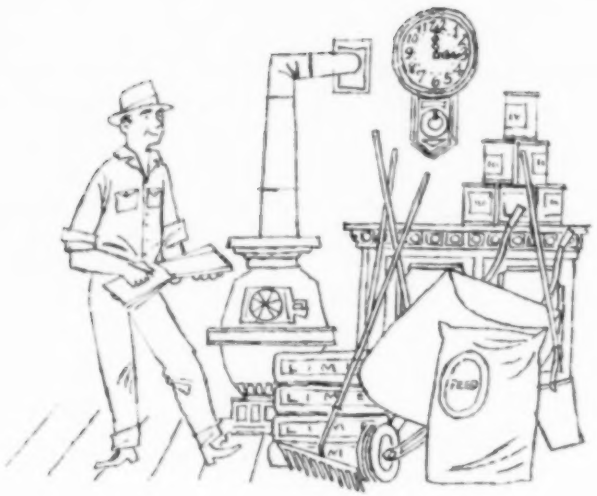
We deliver supplement whenever we are in his locality, just as an oil or gas dealer provides regular deliveries. Our pumps measure the amount the farmer receives and

(Continued on Page 113)

Barney Frankl (seated), general manager of Mor-Gro, discusses sales with one of his staff members.

*Morea liquid feed is manufactured and marketed in most states east of Mississippi by U. S. Industrial Chemicals Co., New York. Feed Service Corp., Crete, Neb., serves the midwest.

What should know



A basic and elementary review of fungicides — for the farmer, dealer, salesman, student.

PART I

THERE are many different pesticides and the number is ever increasing. Thus it is not surprising that it is difficult to have a clear over-all picture. First there are five main classes of pesticides, namely fungicides, insecticides, herbicides, nematocides and rodenticides. The purpose of each is to control respectively fungi, insects, weeds, nematodes and rodents. Chemicals designed to control insects will be ineffective against fungi, despite the fact that they are sometimes used for this purpose. Furthermore only the right kind of fungicide should be used, and in an appropriate manner, to control a given disease.

This discussion will be about fungicides and also nematocides since they are usually considered together. However, it is first essential that we understand just what causes diseases in plants in order that we have a clear idea of the principles of disease control and hence what fungicides to use. Dealers and others interested in fungicides, equipped with a general background of information will be in a stronger position to stock suitable materials and give advice on their use.

What Causes Disease In Plants

THE most important agents of disease in plants are the fungi, which are themselves plants. However, since the fungi lack the green coloring matter, chlorophyll, they cannot manufacture their own food and must live as parasites on green plants, or on dead plants or other material such as wood, cotton, leather and even plastics. From an agricultural standpoint we wish to stop their attacks on living plants and seeds, which usually leads to serious consequences. In the United States alone fungi are estimated to cause some $3,000,000,000 loss in crops annually.

Some of the common fungi generally known are the mushrooms, molds and mildews. The main part of the fungi is the mycelium. This is thread-like and corresponds to the stem, roots and leaves of green plants. In time the mycelium produces its "seeds", more properly known as spores. The spores are microscopic in size and produced in immense quantities. They are blown around by wind and scattered by rain and if they alight on a susceptible plant when temperature and moisture are favorable they will germinate and infect the plant, thus causing a diseased condition. The germ tube develops into mycelium and in time new spores are produced which may infect fresh plants, causing more disease. Often the fungus is out of sight in the plant and only the damage that it causes is visible.

The different kinds of fungi, and there are thousands, cause different kinds of disease. Some, for example, cause only local spotting on foliage and fruit such as apple scab; others may kill the whole plant and even all the plants in a field, as with late blight of potato. In recent years, some progress has been made in developing chemicals to cure plants after they are infected, but generally this is not possible and plants must be protected from infection. That is, a coating of a suitable fungicide is sprayed or dusted onto the healthy plant so that when the

the dealer about FUNGICIDES?

by S. E. A. McCallan
Boyce Thompson Institute for Plant Research, Inc. Yonkers, New York

spores arrive they will be killed or at least prevented from germinating and infecting. Timeliness in application of the fungicides is thus most important. With fruit trees, spray schedules have been worked out by the agricultural experiment stations showing not only what, but also when, to spray. Important vegetable crops, such as potatoes and tomatoes, are often sprayed every week or 10 days, or even oftener, in order to keep the foliage covered with a protective coating of fungicide. In all these applications a protectant fungicide is used.

Seeds of plants may carry fungus spores that will infect the sprouting seed, or mycelium in the soil may attack the seed. The seed decay and damping off they cause often may be prevented and a good stand of seedling insured by treating the seeds before planting with an appropriate fungicide or so-called seed disinfectant (protectant is a better word). However, seed that is actually infected generally cannot be effectively treated in this manner.

The soil contains many fungi, some of which are deleterious and will attack and infect the roots of plants, causing wilts and other diseases. At present the only practical controls are resistant varieties, crop rotation, or soil fungicides. In time chemotherapeutant or systemic fungicides will be developed that will prevent or even cure the wilt diseases.

The bacteria, while prime agents of disease in humans, play a secondary role to the fungi in causing plant diseases. The bacteria are single cell organisms smaller than fungus spores. They multiply by the simple process of dividing into two cells, which they do at a tremendous rate under favorable conditions. Bacteria can cause diseases of all plant parts. Until the discovery of antibiotics, chemicals were generally not very effective in controlling bacterial plant diseases, at least on the foliage. However, some of the antibiotics now appear promising for this purpose.

Viruses are highly infectious agents in the borderland between the animate and inanimate world. They are too small to be seen in the ordinary microscope and are nucleoproteins. Virus diseases usually cause a mottling or yellowing in the diseased plant. To date, no chemical has been found that will give a practical control of virus diseases of plants. However, insecticides may be used to control the insects which spread some virus diseases.

Nematodes are microscopic roundworms which live in or on plants, causing diseases. Frequently they attack the roots or other plant parts, causing galls or cysts. When the nematodes are present in the soil or in plant debris they may be controlled by nematocidal chemicals applied to the soil. Some soil fungicides may also be effective in destroying nematodes.

There are various other plant diseases caused by unfavorable environments such as soil deficiences. These may be controlled by supplying the deficient nutrient chemical and do not call for the use of fungicides. Other diseases or damage may be caused by air pollution with industrial gases.

Fungicides In General

VARIOUS kinds of fungicides have been mentioned, based on their use, such as foliage sprays and dusts, seed treatments and soil treatments. However, a more informative way of classifying them is based on the active ingredient, the chemical that makes them work. Thus from the chemical point of view there are four major groups of fungicides, with the active ingredient consisting of sulfur, copper, mercury or organic compounds. The antibiotics and presently used nematocides also come under the heading of organic compounds.

At this point it should be explained that any given fungicide, or pesticide, may have three different names. On the label in large letters will be the trademark name, for example, "Fermate". By law the percentage of active ingredients must be given. We have in very small letters "ferric dimethyldithiocarbamate-76%". This is the chemical name. Because the chemical names for organic compounds are generally long and difficult for non-chemists, coined or common names have been assigned for some compounds*. The one above is "ferbam"; this is not capitalized and it may or may not be on the label. The advantage to common names is simplicity and hence the avoidance of errors in use. Further-

*This is now done by the American Standards Association.

more, experiment station plant pathologists may recommend a certain fungicide, e.g. ferbam, without specifying any particular manufacturer's trade-marked product. Other trade-marked ferbam fungicides, for example, are Carbamate, Coromate, Ferberk, Ferradow, and Karbam Black. The most important thing is the active ingredient and percentage present. These trade-marked fungicides with the same active ingredient may differ not only in the percentage present but also in the manner of formulation, including the presence of a wetting agent, sticker, etc. The designation 50W after the trade name means 50% active and wettable.

In 1954 a federal law was enacted, popularly known as the Miller Bill, the primary purpose of which was to protect the public from toxic residues on food crops treated with pesticides. Tolerances have been fixed by the U. S. Food and Drug Administration setting the maximum amount of a given pesticide allowed on a particular crop at harvest time. All fresh fruits, vegetables and other raw agricultural products moving in interstate commerce are subject to inspection, and condemnation follows if these tolerances are exceeded. The labels for all pesticides are registered with the U. S. Department of Agriculture. The "Directions for Use" have been worked out by the manufacturer subject to the approval of government agencies so that while adequate control of the diseases or pests specified ordinarily will be obtained, at the same time the tolerances for residues will not be exceeded. Thus it is essential that the grower follow these directions closely as regards the crop, the amount, and the time of application specified. New pesticides may have a temporary label stating "For Experimental Use Only." This means that the information on the control of diseases or pests and the avoidance of toxic residues is still temporary. The material is not for general sale, but is available only in limited quantities and only to experienced persons for the purpose of obtaining more information about these products.

There are a number of products on the market that are mixtures of different fungicides or even of fungicides and insecticides. The object, of course, is to control different diseases or diseases and insects with one application. Such prepared mixtures are especially popular in seed treatment fungicides and home garden sprays and dusts. When a grower plans to mix his own pesticides it is essential that he know whether they are compatible with one another and will not react to produce a mixture that will burn the foliage or be less effective. This information may be provided with the material; also it may be found in various compatibility charts.*

All fungicides are potentially dangerous poisons and should be handled with respect, especially the mercury preparations and soil fumigants. Some of the organic compounds may be irritating to the skin.

In the discussion to follow, various trade-marked products will be mentioned as examples. However, it is not to be inferred that these are the only products, nor necessarily the most effective.

Sulfur Fungicides

THE use of sulfur as a fungicide goes back to ancient times; it is the original fungicide. While sulfur is still a very important fungicide, its use is being cut into by the newly developed organic compounds. The most important applications are for the control of diseases of fruit trees such as apples, cherries and peaches. Sulfur is also fairly effective in controlling the powdery mildew diseases which attack many plants from apples to zinnias. Sulfur comes in three forms: sulfur dust, modified or wettable sulfur, and limesulfur. The best sulfur dusts are finely ground to pass through a 325-mesh screen. The modified sulfurs are prepared by various methods, with the common objective of being readily dispersed and wetted when applied as a spray. Many of these are packaged as dry powders; such as Kolofog, Mike Sulfur, and Sulforon; others, however, are in paste form as Flotation Sulfur, Magnetic 70, and Mulsoid Sulfur. Lime sulfur is prepared by boiling together sulfur and milk of lime. The active ingredients are polysulfides which on the leaf eventually break down to give finely divided sulfur particles. The quality of lime sulfur is based on its specific gravity, with 32° Baumé being the standard. Lime sulfur is diluted considerably with water before use. Sulfur dust and wettable sulfurs are compatible with most insecticides excepting the oils and organic thiocyanates. Lime sulfur is highly caustic and must be used with caution or it will burn the foliage. However, this property enables it to be used as a partial eradicant fungicide where, for example, it will "burn out" or eradicate apple scab. Lime sulfur is incompatible with many insecticides.

Copper Fungicides

THE best known copper fungicide is Bordeaux mixture. Widely used for some 75 years, it was once called the universal fungicide, but now is being supplanted by the organic fungicides. Bordeaux mixture is prepared by mixing together a copper sulfate solution and a suspension of hydrated lime, one or both being in dilute form. The common formula 8-8-100 means 8 lbs. of copper sulfate pentahydrate, 8 lbs. of hydrated lime, and sufficient water to make 100 gallons of spray. It is desirable to have the copper sulfate crystals in finely divided

(*Continued on Page* 111)

*A compatibility chart is published annually by the *American Fruit Grower*, Willoughby, Ohio. Price 25 cents.

Economic Potential in Utilization of Organic Wastes

by M. S. Anderson
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GARBAGE is an important waste product of every home and of institutions where food is prepared. According to calculations, our urban population produces about 2.5 million tons, dry basis of garbage annually. The water content ranges from about 70 to 80 per cent, which means that the amount handled annually is about 10 million tons.

Garbage must be disposed of in some manner. It contains approximately 2.0 per cent nitrogen, dry basis. (5) The potential supply of primary plant nutrients from this source is about 50,000 tons each of nitrogen and phosphoric oxide and about 25,000 tons of potash. When added directly to soil, it has been found to be of more value to crop growth the second year after application than the first. Moreover, it is not satisfactory for direct use on account of its general character. Composting has been suggested as a possible means of converting garbage into a condition suitable for garden use. The composting process requires aeration, moisture, and a considerable period of time. Sample data, given in Table 6, show wide differences in chemical composition. Composts usually contain some soil, which adds to the mineral matter present. The purposes of composting are several: (1) offensive odors are destroyed; (2) the compost becomes air-dry or more easily workable from a physical standpoint, and (3) carbohydrate content is drastically diminished. Such materials are more nearly comparable to farm manure than to commercial fertilizers, but the mineral or ash content is usually higher than in manures. Composts may be very useful in a home garden, but efforts to produce and market these materials have met with much disappointment. In a few areas, small quantities of garbage composts are available commercially, but such areas are of very limited extent and prices high in relation to plant nutrient contents.

A purchaser of garbage compost should look especially to nitrogen and ash contents, since these two factors are usually related to carbohydrate content and the ability of the material to decompose readily in soil without the addition of nitrogen.

A nitrogen content of about 1.5 per cent with an ash content of about 40 per cent should be reasonably satisfactory. The carbon content of the organic portion of the compost may be expected to range from about 40 to 45 per cent. This means a probable carbon nitrogen ratio of about 11:1. When the nitrogen content is as high as 2.5 to 3.0 per cent, losses of this constituent on decomposition and drying are higher than when the lower nitrogen content prevails.

It is difficult to arrive at a fair price for composts in comparison with farm manures. In each case, the content of organic nitrogen and its rate of nitrification or degree of availability to plants when incorporated with soil should be considered. One expects to pay more per unit of such nitrogen than for a unit of chemical nitrogen. The material provides a soil conditioning effect that is not to be ignored on the part of the home gardener. The grower of field crops will seldom feel that he can afford to buy enough compost at 40 to 60 dollars per ton to apply this material at a rate of 2 to 4 tons per acre to farm land in order to get soil conditioning effects comparable to those obtained from proper use of crop residues and cover crops. Furthermore, such an application is frequently insufficient to provide complete fertilization on the most profitable basis. In some cases, fertilizer materials are incorporated with composts. Certain small amounts of nitrogen and phosphates are desirable additions to raw garbage as composting starts. Further additions to finished composts are usually undesirable, however, because different quantities

Table 6. Chemical composition of certain composts prepared wholly or in part from garbage (5).

Location	Total Nitrogen N	Phosphoric Oxide (P_2O_5)	Potassium Oxide (K_2O)	Ash
	Per cent	Per cent	Per cent	Per cent
New York*	1.47	2.25	1.63	72.0
Pennsylvania*	.63	1.10	.22	80.6
Michigan**	3.33	2.31	1.56	34.6
Maryland	1.11	2.98	.69	31.5
Georgia**	1.54	.70	.80	13.7

*Commercial product. **Experimental sample.

of fertilizer ingredients are needed for various crops growing on different soils.

One important feature to keep in mind is the fact that most of our national supply of garbage is produced in cities, remote from farm land where the compost might be applied. Furthermore, residents of a city do not like to have a composting plant in their neighborhood, nor do they want to live on a road that is a route of garbage-carrying trucks.

As far into the future as one can see, disposal of garbage will be: (1) as cooked hog feed, (2) through the local sewer via a garbage grinder; and (3) in a landfill. Some home dwellers who have gardens will continue to use their garbage for soil improvement. Very properly, city people will continue to struggle with the problem of disposal by commercial composting. It is expected that in some places a measure of economic success may be experienced. The economic potential is not great, however, though the conservation factor involved is desirable, and many people will continue to be interested.

Table 7. Annual production and consumption of certain natural organic materials during selected years 1910 to 1950 (10).*

	Cottonseed meal		Castor pomace		Fishery by-products	
Year	Production	Consumption as fertilizer	Production	Consumption as fertilizer	Production	Consumption as fertilizer
	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons
1910	1,326	442	17	17	78	80
1920	1,817	447	15	23	121	100
1930	2,232	215	27	40	127	74
1940	1,882	115	58	65	192	34
1950	2,555	60	73	82	240	8

*From Stat. Handbook 191, pages 34-36.

Wood Products

Wood products added to soil are primarily intended for physical improvement, since they contain very small amounts of plant nutrients. *Sawdust* added to soil can be of great advantage to soil properties, or if improperly used, can be a disadvantage (1,6). The chemical composition of sawdust, which is really that of wood, shows about 50 per cent cellulose, 25 per cent lignin, and 25 per cent pentosans and other organic groups. The total nitrogen is low, average less than 0.2 per cent. With this chemical picture in mind, it is not difficult to see that lignin is the fraction most likely to make an important contribution to the humus content of the soil. Cellulose is the material most likely to be attacked by microorganisms. Nitrogen is essential to their activity. Some soils are capable of providing enough available nitrogen for the decomposition of sawdust while plants are growing, but such is not usually the case. It is desirable to take the precaution of applying about double the quantity of fertilizer nitrogen used normally in the absence of sawdust. The sawdust is worked into the soil, mostly beneath the surface when lawns or golf greens are being established. In gardens, one to two inches of sawdust around roses and other shrubs serves to restrain weed growth.

The overall picture of the use of sawdust and wood chips for soil improvement seems to be that humus is produced, and the effect of humus as well as the fresh wood material is favorable to soil properties. (8) Additional fertilizer is necessary in order that general soil improvement may take place. The lignin of the sawdust is long-lasting. The same is true of the bodies of microorganisms developed as cellulose is decomposed.

Sawdust has an important place in town gardens, but it has not found much place in garden supply stores. Unfortunately, wood products are to a considerable extent produced far from the areas where most needed for soil improvement.

Wood Derivatives for Soil Building

Lignin as a soil builder has been considered extensively, but relatively little field research with the material has been done (2,3). Two important processes for removal of lignin from wood in the paper industry are used. The sulfate process produces a lignin solution with an intolerable smell. It is not considered to be suitable for soil application. The sulfite process resulting in the lignin liquor has been used in a number of field experiments. In New Jersey, it was found to produce favorable soil conditions, but the cost was much too great for use in comparison with the growing of cover crops. Furthermore, the large amount of mineral salts accompanying the lignin might be detrimental to soils if repeated applications were made. It is assumed that 2 to 4 tons of the lignin waste liquor (13), dry basis, (per acre) should constitute a normal application. Millions of gallons of sulfate lignin liquor are poured on gravel highways to stabilize the soil.

Additions of sulfite lignin liquor to sawdust by various means have been suggested for soil improvement, and the processes patented. (7) Attempts are underway to market sawdust so treated and fortified with nitrogen: a part of such nitrogen is thought to be in the form of organic compounds.

Natural Organic Fertilizers:

Several natural organics have had a place as nitrogen-carrying fertilizer materials (10). Some of these have increased in consumption as fertilizer during the past half century, while others have declined drastically. Several factors influence the place of an organic ammoniate as a fertilizer:

(*Continued on Page* 113)

Treatments to Permit Movement of Agricultural Products under Plant Quarantine

by Henry H. Richardson and J. W. Baloch
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ARS, USDA

Conclusion

HCN was adopted in 1956 for the khapra beetle control campaign as an alternate treatment for infested seeds. For this purpose a dosage of four pounds per 1000 cubic feet for four hours at 50° F. or above was specified. HCN has had fairly extensive use for grain fumigation, including rice. It has also been used under high sustained vacuum for the treatment of vetch seed for the vetch bruchid and for broomcorn infested with European corn borer, but has now been replaced by methyl bromide.

HCN has been in long-time use for the fumigation of ships, particularly for Public Health Service quarantine control, and also occasionally over the last ten years for the control of the white garden and giant African snails and similar plant pests sometimes found on various cargo on shipboard. In ship fumigation, HCN is often applied by means of discoids.

HCN or a closely related compound, acrylonitrile, has been used rather widely in the vacuum fumigation of tobacco. In this treatment, the initial high vacuum is usually sustained for the full exposure, since it gives better gas penetration (Johnson *et al.* 1938). Although HCN fumigation is not a quarantine requirement for most tobacco imported into the United States, it is required for use on tobacco exported to some other countries, such as England and India.

HCN at the rate of 40 cc. per 100 cubic feet (5/8 pound per 1000 cubic feet) has also been used in recent years for the quarantine control of the Hall scale on prune and other trees in California. The entire tree is fumigated under a gas-tight tent during the dormant season. Nursery stock shipped out of the Hall scale quarantine area is given a high-vacuum fumigation.

Other Chemicals

DDT, chlordane, dieldrin, and several other chemicals have been approved in the domestic quarantine for treatment of bulk soil for shipment out of areas infested with the Japanese beetle. Mixtures of chlordane with ethylene dibromide have also been used for treatment of soil balls around the roots of nursery stock or on turf from the same areas. Carbon tetrachloride has had some quarantine use for fumigation of seeds and other commodities, and chloropicrin as a soil fumigant for various pests, but plant tolerance to both these chemicals is generally very low. Ethylene oxide-carbon dioxide (10-90 mixture) has been used as a fumigant for imported spices and other commodities. It has some fungicidal and bactericidal action which may lead to further quarantine use, but plant tolerance is probably quite restricted. Ethylene chlorobromide has shown promise as a fruit fly fumigant, but it is not quite as effective as ethylene dibromide (Hinman 1954) and has had little practical use thus far.

Cold Treatments

Cold Storage

THE cold-storage and frozen-pack treatments are used almost exclusively for fruit fly quarantine control. The cold-storage treatment consists of precooling the fruit to its center to near 34° F. and holding it at or below that temperature for 12 to 22 days, depending on the species of fruit fly and the treatment temperature maintained.

Following the work of Lounsbury (1907, 1908), Hooper (1907), and Back and Pemberton (1916), the first large-scale use was on Florida citrus in 1929 for the eradication of the Mediterranean fruit fly. The treatment finally adopted there called for a 15-day exposure at 30°-31° F. (PQCA 271). It was later adopted for grapes imported from areas infested with the Mediterranean fruit fly (12 days at 34°), as well as for citrus infested with either the Mexican fruit fly (18 days at 33° up to 22 days at 35°, Baker *et al.* 1944) or *Anastrepha suspensa* from Puerto Rico (15 days at 34°). According to Christenson (1953), Balock and Kozuma found the oriental and melon fruit flies in Hawaii slightly more susceptible to cold temperatures than the Medfly, but many tropical fruits cannot withstand this degree of cold storage.

The treatment was applied originally only in approved cold-storage plants that had adequate insulation, cooling capacity, and uniform forced-air circulation. Later, following the studies of Nel (1936) and Hawkins and Becker (unpublished), it was adopted for application on ships (BEPQ 464). Since the fruit must be kept under refrigeration to prevent spoilage,

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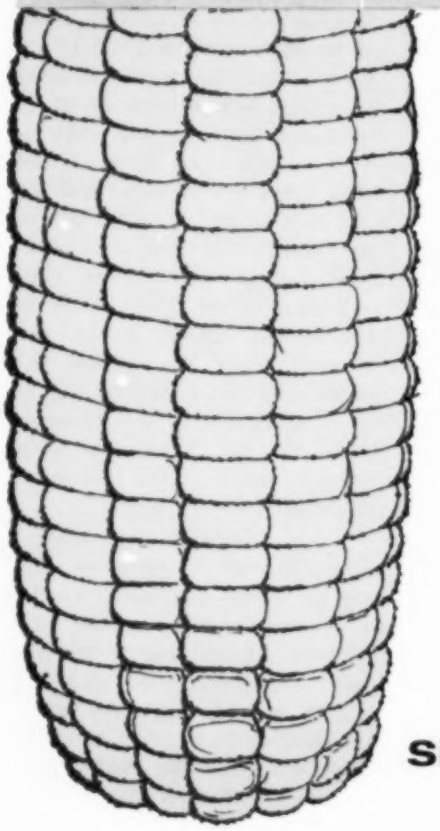

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the use of cold storage as a quarantine treatment during the voyage has proved to be very practical (Richardson 1952[a]). The fruit generally arrives in excellent condition because of the uniform precooling and temperature regulation. The latest schedules include 11 days at 33°, 12 days at 34°, or 14 days at 35° F. for fruit from Mediterranean fruit fly areas. Fruit from Argentina, where *Anastrepha* sp. and other fruit flies are present, requires 13 days at 33°, 15 days at 34°, or 17days at 35° (PQ 583). Hundreds of tons of fruit are treated in this way each year. Considerable fruit that will withstand long cold storage, such as apples and pears, is also treated in cold-storage warehouses on arrival at a United States northern port.

An advantage of cold-storage and other cold- and heat-quarantine treatments is the freedom from any chemical residue in or on the commodity. The lower efficiency of cold storage against many insects other than fruit flies restricts its use.

Frozen Pack

THE frozen-pack treatment consists of initial freezing at subzero Fahrenheit temperature, and subsequent storage at not higher than 20°. It differs from all other accepted methods in that, to avoid spoilage, the fruits or vegetables must be used very soon after the treatment temperatures are relaxed. It was first approved in the United States in 1931 for fruits from various fruit fly infested countries (PQCA 311, Mason and McBride 1934, and BEPQ 462) and later (1950) extended to vegetables (BEPQ 587). It is probably effective against most all fruit flies and also against some other insects (McBride and Mason (1934), but it is not authorized for use on commodities subject to pests that can't be destroyed by freezing. During recent years it has been used for the treatment of Hawaiian pineapple, and also some guava and passion fruit preparations, and for certain Puerto Rican fruits (BEPQ 585 and 586). With the great increase in marketing of frozen fruit and vegetables, the frozen-pack method may develop into wider quarantine use.

Heat Treatments

Vapor Heat

IN this treatment, the commodity is heated by air saturated with water vapor at 110° F. The vapor condenses on the fruit or vegetables being treated and gives up its latent heat. This latent heat is essential in raising the pulp temperature evenly and quickly so as to prevent damage to the commodity. In application, the saturated vapor is accompanied by a fine water mist and air under forced circulation. The pulp temperature is raised to 110° and then held there for six to eight hours in order to kill various fruit flies (Baker 1952). It was first used on a large scale on Florida citrus in the 1929 Mediterranean fruit fly outbreak. An eight-hour warm-up and an eight-hour holding period were used (PQCA 252). When the treatment was later adopted for the Mexican fruit fly in citrus, the holding period was reduced to six hours. Later an alternate schedule consisting of a six-hour warm-up with a rapid increase in temperature in the first two hours and a four-hour holding period at 110° was also allowed. (BEPQ 575 and 542).

Vapor heat was later approved for the treatment of Mexican citrus and Manila mangoes (Balock and Starr 1945) for control of the Mexican fruit fly. It was also applied to Hawaiian fruits and vegetables for the Mediterranean fruit fly and the melon fly. The oriental fruit fly, found in Hawaii in 1946, apparently proved more resistant to vapor heat, and it was necessary to extend the treatment to 8¾ hours after the pulp temperature had reached 110° (BEPQ 481). The following Hawaiian fruits and vegetables have been treated successfully: papayas, bell peppers, pineapples, Italian squash, and tomatoes (Balock 1951). In addition, a so-called "quick run-up" to a minimum pulp temperature of 117° was adopted (PQ481), which had the advantage of reducing the treatment time considerably (Christenson, Steiner, and Balock 1956). In these more severe treatments stress was laid on cooling the fruits and vegetables immediately after the exposure. However, occasional injury to treated commodities has occurred. In addition, vapor heat was found sufficiently injurious to California citrus (Claypool and Vines 1953) and avocados (Sinclair and Lindgren 1955) to eliminate it as a treatment for these fruits. The treatment also gave a definite off-flavor to most types of California citrus.

In Hawaii, vapor heat is still the method of choice for treatment of papayas, since storage rots that affect shelf life are inhibited by the heat. Considerable Mexican citrus has also received this treatment. The shorter exposure time that is effective against the Mexican fruit fly was used, but recently vapor heat has been replaced by the faster, more easily applied, and better tolerated ethylene dibromide fumigation.

Hot Water Dips

A HOT-WATER dip treatment for various bulbs and other plants has been in quarantine use for some time. It was adopted in 1926 for imported narcissus bulbs infested with various bulb flies and the bulb nematode. The original treatment specified submersion of bulbs in water at 110°-111.5° F. for not less than 2½ hours. Uniform temperature should be maintained during the treatment by the use of propellers or other means of forced circulation (HB 195). Later the treatment was revised—mainly for nematode control—to include a preliminary two-hour soak of the bulbs in water at

70°-80° followed by a four-hour submersion at about 111°. Formaldehyde at approximately 1-400 was used to increase the efficiency against the nematode, as well as to prevent dispersal of the bulb rot organism (Courtney *et. al.* 1947). An immersion of 1½ hours at near 111° is usually sufficient for bulb fly larvae or various species of bulb mite infestations (Doucette 1941). Bulb tolerance is best three to four weeks after harvest. Sprouted bulbs are much more liable to injury. At present, the treatment is in little use on imported bulbs, but is in some use in bulb areas in the Pacific Northwest as well as other countries.

Hot-water dips, usually at shorter exposures and higher temperatures, have also had some restricted use for treatment of various plants, especially roots and tubers infested with nematodes or carrying nematode cysts or other pests. On chrysanthemums, a 20-minute dip at 110° F. has been used for leaf miners and other pests. A 30-minute dip at 118°-118.5° was used recently for the treatment of lily-of-the-valley pips for golden nematode quarantine (Richardson and Spruyt 1952). Resurrection plants *(Selaginella lepidophylla)* have also been treated. A 30-minute dip at 118° has been used for *Meloidogyne* or *Pratylenchus* nematodes in peony roots, clematis, tuberose, and other plants. A large number of plants will not tolerate such treatment. For calla roots, a treatment for 30 minutes at 122° has been used, since these plants have a better tolerance for hot-water dip and there is also some disease control. Short-exposure dips to higher temperatures have been used for mite control on strawberry. Hot water at 130° or above has also been used for control of certain disease organisms on or in seeds.

Other Heat Treatments

STEAM under pressure was used occasionally for quarantine treatment of broomcorn for European corn borer control, but methyl bromide fumigation has entirely replaced it. Steam sterilization has also been used on bulk soil or other commodities. Dry heat has been authorized as a cottonseed treatment for pink bollworm control, but otherwise it has had little practical use.

Irradiation

RADIATION employs the principle of nuclear ionization to destroy or inactivate insects or microorganisms. In recent years, the development of atomic research has stimulated work on the control of insects by irradiation. Hassett and Jenkins (1952) reported that gamma rays were much more effective in killing insects than bacteria, which require 1,000,000 r, or more. Working principally with stored-product insects, they found that 65,000 r was sufficient for quick and complete destruction, which was needed in heavy infestations to prevent further feeding damage. Light infestations could be controlled with smaller dosages, which prevent reproduction. Similar results were reported by Proctor *et al.* (1954) working with gamma, cathode, and X rays on five species of stored-product insects. They found dosages as low as 12,500 r effective in destroying some insects in all stages within a few weeks, but much higher dosages (300,000 to 600,000 r) were required for immediate destruction.

Studies conducted in Hawaii indicate promise for irradiation as a quarantine treatment for fresh fruits and vegetables infested with fruit flies and possibly other insects. Although dosages greater than 300,000 r were required to cause immediate destruction of all fruit fly stages, development to the adult stage was prevented by dosages a little below 10,000 r (Balock *et al.* 1956; Balock and Burditt unpublished). Mangoes tolerated 200,000 r, and cucumbers were unaffected by 50,000 r of gamma rays and showed only slight softening at 100,000 r. Pomerantz and Morgan (1955) reported favorable results with cantaloupe and cherries exposed to 1,000,000 r, grapefruit showed no loss of acceptability at 500,000 r, whole peaches were acceptable following treatment below 1,000,000, and plums with less than 400,000 r. With vegetables acceptable irradiation levels were 150,000-210,000 r for squash and 100,000 r for whole, under-ripe tomatoes. These tolerances are well below irradiation dosages found to be completely effective in preventing fruit fly reproduction.

Summary

A REVIEW is given of various quarantine treatments developed to permit movement of agricultural commodities since the passage of the Plant Quarantine Act of 1912. Large amounts of imported and domestic agricultural commodities – including dormant plants, seeds, fruits and vegetables, bales of cotton and bagging - are now treated each year to prevent the entry of quarantinable insects or other pests.

Methyl bromide fumigation probably has the largest use. Fumigation with ethylene dibromide is finding increased use, especially on tropical fruits imported from fruit fly-infested areas, but at the low dosages ordinarily used it has lower efficiency against most other pests. Hydrocyanic acid gas, one of the earliest developed treatments, still has some use on cotton bales; it is effective against many insects but has properties that restrict its practical application. Cold-storage treatment near 34°F. has extensive use, especially on deciduous fruits brought in from fruit fly infested countries. The frozen-pack treatment at about 0° has some use on certain Hawaiian and other fruits. Vapor-heat treatment at 110°-117° has a special use on Hawaiian papayas, where it not only kills fruit flies but it also helps reduce losses due to storage rots. Hot-water

(*Continued on Page* 119)

Biological Control of Noxious Insects, Weeds

First installment of a two-part report.

by C. H. Hoffman*
Entomology Research Division
Agricultural Research Service
U. S. Department of Agriculture

IT is estimated that we have 10,000 injurious insects in the United States and in spite of many effective control measures insects still cause losses of about $4,000,000,000 each year. Weeds are replacing large acreages of otherwise desirable rangeland in the West.

To control insects which threaten our food and fiber supply and transmit deadly diseases to man and his crops and livestock, entomologists recommend several methods including cultural practices, biological-control agents, crop varieties resistant to insects, and a vast array of insecticides.. Biological-control agents are important checks on many destructive pests, but when they do not give the degree of control required for production of good crops of high quality, growers must resort to other methods. Hence, today, greatest reliance is placed on insecticides. Since certain insects have become resistant to some insecticides, and since some insecticides leave residues that limit their use on certain crops or may be inimical to fish and wildlife, there has been an increasing interest in biological control. Where biotic agents cannot be substituted for insecticides, it may still be possible to use them as supplements and thus reduce the overall amount of chemical required.

Kinds of biological-control agents.—The term "biological control" means the control of an animal or plant through the action of other living organisms. By control the economic entomologist means holding the population of an injurious insect below the level that causes economic damage. All insect parasites, predators, or disease-producing microorganisms, such as viruses, bacteria, fungi, protozoa, and nematodes. Weeds also have insect enemies, and efforts are being made to take advantage of this fact. A number of higher animals, notably mice, skunks, and birds, destroy insects. Agents that exert biological control of insects are either native in this country or they have been introduced when conditions were favorable. Without these natural enemies we would be overcome by destructive species. However, the grower and others affected by insects want a method of control that prevents economic damage.

Most of our serious insect pests originated from abroad and became established and flourish in this country without the hindrance of their normal complement of natural enemies. To overcome this situation, entomologists for over 60 years have been making explorations in many parts of the world to find parasites and predators that could be used to control these introduced pests. The importation of beneficial insects is largely a responsibility of the Entomology Research Division. Such importations must be made with great care, for we must be sure that no crop pests are introduced. Practically every parasite or predator of a pest species has its own natural enemies, known as secondary parasites or hyperparasites. Therefore, before introducing a parasite or a predator into a new area, extreme care must be taken to prevent also introducing its natural enemies. After they have been through quarantine, parasites, predators, and other beneficial insects are sent to Federal or cooperating State laboratories for release or for rearing and colonization prior to release, after which there are recovery programs to determine their effectiveness against specific pests.

Use of biological-control agents.—Advocates of biological control point out that it is Nature's way of keeping a reasonable balance in populations, and that it is a cheap method. The introduction of specific agents that have been unusually successful against certain pests has borne this out. On the other hand, most of the introductions made thus far do not provide economic control of serious pests. Of course, the availability of biological-control agents that meet this test would obviate the use of insecticides and also help solve the increasing problem of resistance as well as attendant residue problems. Without man's help we can hardly expect them to control most pests. Nature usually provides a balance in numbers so that the predator and the plant or animal host also survive. Therefore, biological-control agents alone will not solve all insect problems.

The use of insecticides to control pests or to supplement natural control is currently necessary. In some cases the insecticides upset the balance in favor of the destructive insects. This is not always true, however. Recent claims have been made that parasites and predators of the spruce budworm and the gypsy moth have been destroyed by DDT and that conditions will be worse than before spraying. Such

*Presented before the 23rd Annual Convention of the National Wildlife Federation, New York City, February 27, 1959.

claims are unsubstantiated. Studies show that stages of beneficial insects concealed at the time of spraying, even inside the insect host being sprayed, survive and subsequently attack survivors of the injurious species.

It is gratifying to note that more studies are getting under way to find ways of using biological-control agents in combination with sprays under circumstances where the beneficial organisms alone cannot provide economic control. Another possibility is to propagate beneficial insects and disease organisms and release large numbers under favorable conditions in an effort to get quicker and better results.

I will not cite a number of cases where different biological-control agents have been used for the control of noxious insects and weeds on crop land, pastures, and forests.

Parasites and predators.—About 95 introduced parasites and predators of insect pests are now established in the continental United States, whereas approximately 390 species were imported and colonized but failed to become established (Clausen 1956). C. P. Clausen, a widely recognized authority in this field, states that "The results of biological-control work in the continental United States for more than 60 years indicate that only a small portion of our most important agricultural pests can be fully controlled by this method and that with a substantial number of them no reduction whatever can be attained. However, most of the biological-control projects may be expected to yield a partial control, the benefits derived therefrom being in the form of reduced injury to crops and a lower total cost for chemical and other means of control that still need to be practiced." (Clausen 1956)

Over 20 species of parasites of the oriental fruit moth, involving thousands of specimens, introduced from Europe, the Orient, and Australia from 1930 through 1939 to control this pest of peaches in the eastern United States, failed to be of value, although several species multiplied rapidly immediately following their release. However, the native parasite *Macrocentrus ancylivorus*, previously reared only from the strawberry leaf roller, adapted itself to the oriental fruit moth and caused a fairly high degree of parasitization. Heavy liberations of reared parasites have resulted in a 50 to 80 percent reduction in fruit injury. In an effort to eradicate the oriental fruit moth from California, over 48 million of these parasites were released in infested orchards and greatly outnumbered the host, but the parasite failed to become established (Clausen 1956).

The Comstock mealybug became of commercial importance in apple orchards of Virginia, West Virginia, and several other eastern States during the 1930's. From 1939 to 1941 hymenopterous parasites were introduced from Japan, and within a few years they brought the pest under complete control.

Of 15 natural enemies of the Japanese beetle introduced from the Orient between 1920 and 1933, five have become established but only two wasps, *Tiphia popilliavora* and *T. vernalis*, which attack the grubs in the soil, have contributed materially to its decline in numbers. It has been difficult to evaluate the efficiency of these parasites, which occasionally attack up to 65 percent of the grubs in the soil. These parasites have undoubtedly prevented buildup of the pest, but in spite of their help as well as other control measures, this beetle continues to spread southward and westward.

Undoubtedly one of the outstanding illustrations of effective biological control was the importation, in 1888, of a ladybird beetle from Australia to California to control the cottony-cushion scale on citrus. The initial investment of less than $5,000 resulted in benefits to our citrus industry amounting to millions of dollars annually. It has been standard practice to purchase these ladybird beetles from commercial sources when needed to control this scale.

During the last 30 years over 3 million parasites of the European corn borer have been imported from Europe and the Orient and equal numbers reared in this country have been released to help control this destructor of corn. Of 24 species imported and colonized, 6 have become established and 2 are of considerable importance. The parasitic fly *Lydella grisescens* is probably the most effective species, being widely distributed with field parasitization ranging from 10-75 percent. The wasp *Macrocentrus gifuensis*, is found largely in the eastern States and parasitizes up to 52 percent of the borers. These parasites have undoubtedly been of great value in reducing losses by this major pest, but the control is inadequate to prevent economic loss and further spread.

Great interest has centered about a recent study in North Carolina involving the control of hornworm larvae on flue-cured tobacco by *Polistes* wasps. In a number of localities the wasps, provided with inexpensive shelters that protected their nests and brood from larger predators, increased in abundance and reduced moderate hornworm infestations to noneconomic levels. This is an example whereby improving the environment for the predator tipped the balance in its favor.

Disease-producing micro-organisms. These micro-organisms—bacteria, fungi, viruses, protozoa, and nematodes—have not been studied as exhaustively as parasites and predators for the control of insect pests. Some lack of interest may have been due to earlier studies linking their effectiveness with the weather and also the importance of accurately timing applications. Nevertheless, since certain microbial agents can be produced at a reasonable cost, are generally harm-

(*Continued on Page* 91)

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LISTENING POST

By Paul Miller

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Mycology and Plant Disease Reporting Section, Plant Protection Research Branch, United States Department of Agriculture, Beltsville, Maryland.

Chemical Control of Onion Bloat Nematode in Organic Soil

G. D. Lewis and W. F. Mai* report that experiments conducted by the Department of Plant Pathology, Cornell University, Ithaca, New York, have resulted in an efficient and practical chemical control of onion bloat caused by *Ditylenchus dipsaci*.

Since 1951, this nematode has caused heavy losses in onions grown on organic soils in southern New York. Rotation with nonsusceptible crops had been found to be extremely effective in controlling, or even sometimes eradicating the nematode. However, because onions were so much more profitable than some other crop, growers were confronted with an economic problem. If they grew other crops in rotation, they lost more money than they lost from damage due to the nematode, but if they grew onions continuously, the nematode population rapidly built up to destructive proportions. The most desirable appeared to depend on the discovery of a satisfactory chemical control of the nematode pest.

Lewis and Mai review previous attempts made to control the nematode by soil treatment. Most of the treatments that had been tried, including steam treatment as well as chemicals, did not give satisfactory results,—were injurious at effective rates, or were too expensive for commercial use. Many effective nematocides contain bromine; if these are used, according to the authors, residues that are toxic to onions may be left in the soil. Another important consideration in developing a chemical treatment is the much greater amount of fumigant needed to produce satisfactory control in organic soils than in mineral soils, as much as 50 to 100 per cent more being required for the former.

MATERIALS AND METHODS:

The most promising material for trial appeared to be D-D (1,3-dichloropropene and 1,2-dichloropropane), despite the fact that it had been reported not to be satisfactory for onions under the conditions of tests made on organic soils in northern New York. It was not effective there at the lower rates, and caused injury at the higher rates used in the tests. Better results had been reported from other locations, however. As D-D was the only commercially available and economically practicable material suitable for large-scale use that did not contain bromine, the authors decided to try it, using higher rates and combining soil treatment with other control practices.

Five fields known to be infested with *Ditylenchus dipsaci* were used for the trials. Since the nematodes could be spread in the fields by the cultivation employed for weed control (even after harvest),—and since such spread could originate either in untreated portions or in unsuccessfully treated portions of a field, each field was treated uniformly throughout its area. Application was by means of a tractor-mounted pressure-type applicator, with shanks spaced 11 inches apart set to deliver the chemical at a depth of 6 inches. Before it was fumigated, the soil was plowed or harrowed to the 6-

(*Continued on Page* 109)

Table 1. Comparison of onion yield in experimental fields before and after fumigation.
[From Lewis and Mai; see Footnote.]

Field number	Treatment	Yield (bushels per acre)		
		1954	1955	1956
1	50 gallons/acre D-D preceded by 1 year lettuce	0	lettuce	884
2	Calcium cyanamide followed by 50 gallons/acre D-D		589	1076
3	Split application of D-D 60 + 50 gallons/acre		395	1022
4	50 gallons/acre D-D		310	740
5	50 gallons/acre D-D		1032	963[a]
6	No infestation No fumigation		859	876

[a] Foliage blights severe in 1956.

*G. D. Lewis and W. F. Mai, "Chemical control of Ditylenchus dipsaci (Kühn) Filipjev in organic soils of southern New York," Plant Disease Reporter, Vol. 42, No. 12, pages 1360-1363, Dec. 15, 1958.

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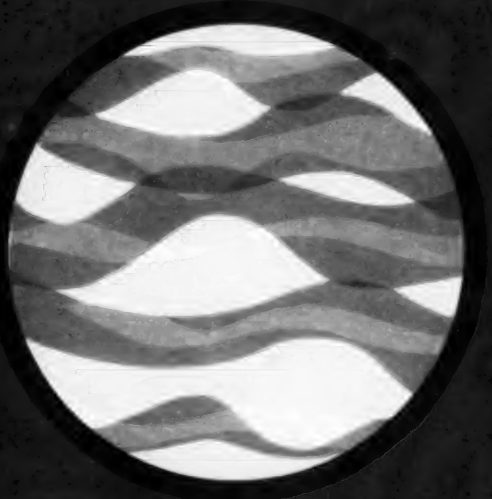

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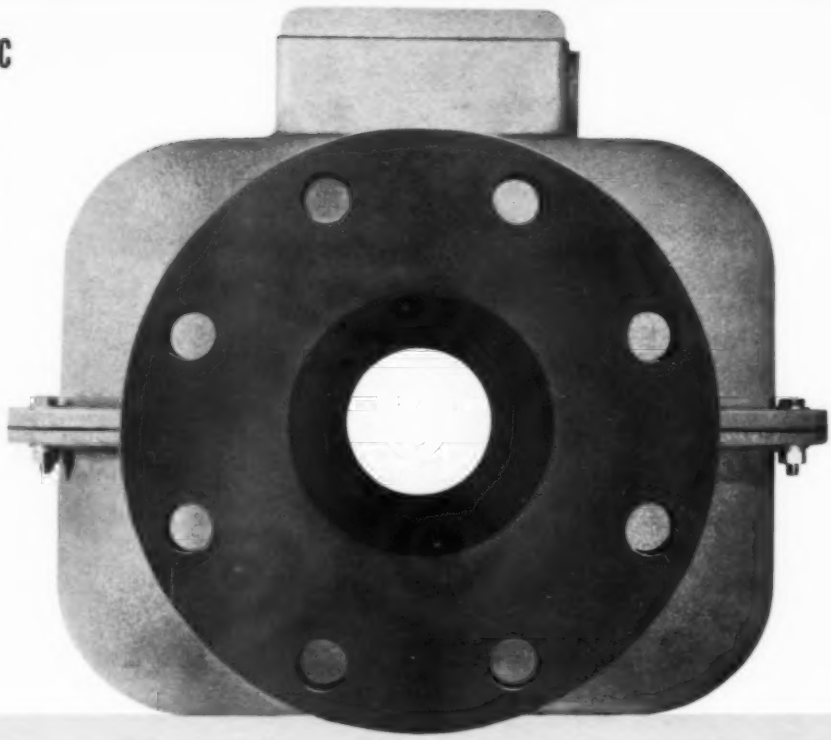

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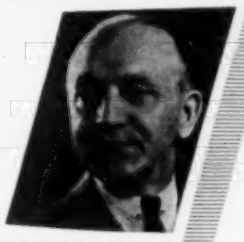
Fertilizer Views and News



By Vincent Sauchelli

Dr. Sauchelli is Chemical Technologist for National Plant Food Institute.

Some Concepts of Statistical Control Techniques Simplified

"YOU mean to say that the general attitude of the thinking public in our country in the late 19th Century toward business practices was deeply influenced by Darwin's theory of evolution, 'the survival of the fittest?' That the cutthroat competition associated with the first Rockefeller and Harriman and Carnegie was somehow linked with those scientific teachings?"

"Yes, incredible as it may seem, Darwin's exposition of the method of jungle warfare in nature apparently seized the imagination of people and the bolder ones applied it to business practices."

The preceding snatches of conversation were overhead recently on a visit to a local college campus. The speaker went on to show how in our day another principle from the teachings of Science is being learned and applied: the lesson of symbiosis. The symbiosis concept relates to that intimate association of two unlike species for their mutual advantage. For example, the root nodular bacteria and the legume plant as the host. The close association of science and business in our day is symbiotic and is responsible for the remarkable progress currently evident in the fields of technology.

Among the many important developments and accomplishments of this symbiotic relationship, one stands out: the development of statistical quality control as an indispensable tool. The use of statistical techniques by progressive management, chemical engineers and all others responsible for making decisions is an achievement of our modern times. The agronomist working with variations of soil, plant varieties, nutrient levels and weather; the physicist making precise measurements; the control chemist involved with variations of size, shape, density and moisture in samples and differences in glassware, balance readings and temperatures; the plant superintendent interested in efficient production, high quality and minimum unit cost of production;—all these use or could use statistical techniques.

Although statistics is recognized by many leaders now as an acceptable research tool in every field of science, its proper use is far from being universal. Having had to familiarize myself with this subject of statistical control in connection with one of the important research projects sponsored by the National Plant Food Institute, I have become very enthusiastic about it. This and subsequent articles on the subject reveal my desire to share with our industry some of the things I have learned and to point out where they may be put into rewarding practices.

Let us face it: the fertilizer industry is not using this modern tool.

Why, it may be asked, is it lagging in the utilization of this powerful aid? Too much calculation? or too much mystic jargon? or the feeling it does not need it? Statisticians do use a jargon in their efforts to describe the technique and how it is applied which has discouraged many beginners. However, the main concepts of the subject can be explained in current, jargon-free American speech with very few new words. It is the ideas, not the terms, or even what seem formidable computations cluttered with Greek letter symbols that are the important core of the subject. The basic ideas rest upon the following concepts.

No two things are identical. Variation arises from many sources: raw materials are not uniform, equipment or steps in processing them differ; workers differ in skill, grow tired and careless; temperature and humidity conditions vary; sampling techniques and instruments vary; measuring devices of all kinds vary.

Generally, each individual item in a series of similar parts will approximate in size, weight, hardness and other physical characteristics an ideal part whose dimensions are the average dimensions of all the individual parts. It is assumed that this ideal part meets the specifications exactly. However, the statistician recognizes the possibility of variation by setting plus or minus limits and these are known as tolerance limits for each important dimension.

Besides getting the mean or average value of a dimension with its plus and minus tolerance limit, the statistician or engineer wants to have some measure of the variation. It is a fact that the positive and negative deviations about the mean value cancel each other out, and the average deviation is always zero. Hence, this is no value for

(*Continued on Page* 104)

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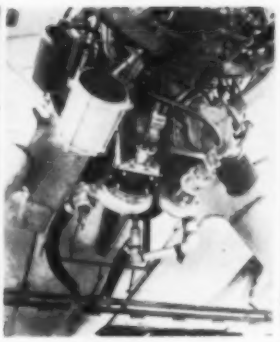
- **Illinois Spray School**
- **CAAA Meeting Report—Conclusion**

Aerial Application in the U. S.

The Butler-Norman spinning cage spray device (English) for fine atomization is shown on an Auster J5 high-wing monoplane.



A dual spraying arrangement on a Stearman plane uses hydraulic motors driven by pumps on the P.T.O. pods of the engine.

For experimental work in the U. S. a Stearman is equipped with two complete spraying systems with two booms and two sets of nozzles.

*By Norman B. Akesson and Wesley E. Yates**

AGRICULTURAL use of aircraft continues to increase throughout the world each year. While a significant portion of this increase is due to the rapid development of new chemicals and their gaining acceptance by farmers of the world, the increasing complexity of handling and use of these chemicals plus the additional capitalization of machinery required, favors the development of commercial operators. In turn, the timeliness, through rapidity of treatment, the operation above the crops, and the competitive cost structure, places aircraft operations in an advantageous position.

Overseas, the greatest concentration of agricultural aircraft is in New Zealand where approximately 300 aircraft applied ½ million tons of fertilizers to about four million acres of range and pasture land in 1957. Australian aircraft use is not as impressive as this, but is spread over a greater range of application work, with the most rapid expansion now taking place in rice production, seeding, fertilizing, weed and insect control and defoliation.

Similarly, in Hawaii, aircraft spraying and fertilizing on sugar cane has become of considerable importance in the last three or four years. Pest control spraying and dusting by aircraft is continuing in a limited way in Europe, with a sizeable acreage of potatoes (30,000) being sprayed with copper fungicides for blight control in England in 1957. Potato spraying also is being carried on in Holland, Germany, and France, and a considerable acreage of cereal grains is being treated in Sweden. Thirty Piper Cub airplanes reportedly were in use in Sweden this past year. However, the use of aircraft on the relatively small farms and fields of Europe is not of the same order of promise as the development of aircraft use in the lesser developed areas of Africa, Asia, and South America.

Limited operations have begun in these areas, usually on lands controlled by government or by European farmers on fields of sufficient size to make aircraft use profitable and practical. The native agriculture in many of the lesser developed areas is on fragmented plots of land with a single owner sometimes having a half dozen of the 1/10 to two or three acre plots scattered over a 10 square mile area. Aircraft operations at present, therefore, will be found primarily on the export crops in specific areas. Rice in parts of Peru; coffee, edible dry beans and cereal grains in East and South Africa; cotton in the Sudan and bananas in Honduras are some of the typical specific area crops being treated.

It is interesting to note that the use of aircraft for control of malaria-carrying mosquitos, locusts, and tsetse fly has reached a high state of development in such infested areas as Northern and East Africa, Middle East and Southeast Asia, and parts of South America. These programs generally are financed by government organizations.

The English, French, Belgian, and Dutch Colonial development organizations have been foremost in this extremely desirable work. Our association in East Africa was with the English Colonial Pesticide Research Organization whose pri-

*Associate and Assistant Agricultural Engineer, respectively, University of California, Davis, California.

& Abroad

A French "Ag Copter" with a turbo-jet engine that forces compressed air out the rotor tips is equipped with an agricultural spray boom.

Professor Akesson is shown beside an Auster J5 equipped with the Butler-Norman sprayer in this photo taken in Tanganyika during 1957 while he co-operated with the English Colonial Pesticides Research Unit on agricultural spraying studies. The Auster J5 carries about 40 gallons of spray.

mary work was on mosquito and tsetse fly control, but who also were developing information on pesticide applications for agricultural crops.

In the United States, the extent of aircraft usage in agricultural pest control and fertilizing and seeding is best expressed by a few statistics. Of the 350 million crop acres in the U. S., over 60 million treated acres were covered by aircraft last year, or about one acre in every six. Spraying for weed, fungi, and insect control and defoliation constitutes about 66 per cent of the work, with dusting at 23 per cent, and fertilizer and seed operations less than 10 per cent. The bulk of applications were for insect control at 75 per cent of the total, plant disease at two per cent, weed and brush control at 12 per cent, defoliation 3½ per cent, seeding 2½ per cent, and fertilization five per cent. Forest spraying by aircraft was nearly 17 per cent of the total, or 10 million acres.

Dusting, granule, and seed spreading were developed primarily by aircraft operators in the United States after the first war. Governmental assistance, including the USDA, encouraged this early work, but the agricultural aircraft industry was built up on the cotton of the South and the orchards and rice fields of the far west, with little research support. Spraying, however, was little practiced up to the second war, outside of a few specialized whirling brush and spinner devices and nozzles placed in the dry spreaders, until military and public health agencies developed the aerosoling and spraying equipment as we know it today. Overseas countries, particularly those with colonial interests, picked up what information was available in the U. S. during and after the second war and carried on from there.

One of the outstanding chemical aircraft research activities is that conducted by the colonial service in England. The main station for this work is at Portion, near Salisbury, basically a military research station. Here the emphasis has been on personnel insect control and the primary objectives have been mosquitoes, tsetse fly, and locusts. Agricultural spraying may sometimes use the techniques of small particle size, wide swaths, and high altitude flying generally associated with mosquito work, but it is more frequently desirable to use a large particle, applied at low altitudes, and at higher gallonage to obtain greater residual deposit and more lasting results.

The testing done at Portion over a period of several years included a variety of techniques. Various aircraft were used, from helicopters (Bell 47/3B) to Auster J5 (similar to a Piper) and the DeHaviland Beaver, about the size of the Stearman; the Tiger Moth, a smaller biplane than the Stearman, and on up to the larger planes of the Anson class, around the size of the DC 3. Equipment used ranged from single outlet drop pipes, through the usual boom and nozzle arrangement to the whirling brushes and cages used for producing very fine atomization, bordering on aerosol classification. In addition to the aircraft testing work, investigations have been conducted on deposit and coverage of insecticides by various size droplets in a wind tunnel, and also nozzle atomization.

An interesting phase of aircraft spraying which has been in-

(*Continued on Page* 124)

This article is taken from a paper presented at the meeting of the American Society of Agricultural Engineers in Chicago, Dec. 1958.

Versatile Row-Crop Sprayer-Duster Developed

A VERSATILE row crop-sprayer-duster, developed cooperatively by the U. S. Dept. of Agriculture and state research personnel for the control of aphids on potato plants, holds promise for use on several other low-growing row crops.

Used successfully in aphid-control tests during the past three years in potato-growing areas of Oregon and Washington, the sprayer-duster will be tried out as a means of applying insecticides to lettuce and broccoli. Other row crops to which the machine may be adapted include string and lima beans, egg plant, cabbage, cauliflower, collards, and strawberries.

The sprayer-duster can be adjusted for use on low-growing crops of different row spacings. Treating booms may be moved horizontally and vertically within rows. This permits the spray nozzles and dust outlets mounted on the booms to be operated at a uniform height above the ground. The result is accurate placement of pesticides on upper and under parts of plants.

With currently used insecticides the research workers obtained almost complete control of aphids. The unit can be powered by a row-crop tractor or other suitable vehicle. A horizontal tubular drawbar is attached to the vehicle at a right angle to the direction of travel. Trailing spraying-dusting booms are attached by a universal joint to the drawbar.

Agricultural Engineer Silas D. Young and entomologist Joseph C. Chamberlin of the USDA's Forest Grove, Ore., station developed the equipment.

•

Illinois Spray Groups Meet

The Illinois Association of Aerial Applicators and the Illinois Ground Sprayer's Association met in a joint meeting at the University of Illinois, Urbana, on Jan. 26.

Dean Harold Hannah, a legal authority of U. of Illinois College of Agriculture, addressed the combined groups on the subject, "What is a Contract—Its Legal Interpretation." Dean Hannah stressed the importance to the operator of informing neighbors of work to be performed in their area. He covered various liabilities as well as the pros and cons of corporations vs. proprietorships.

A business meeting was held by the aerial applicators at which time they discussed future and anticipated legislation in Illinois which might affect aerial applicators. They also covered public relations publicity and new equipment.

Bob Danforth of Danforth Aerial Sprayers, Monmouth, Ill., was re-elected president of the aerial group. Myrle Stinnett, W.I.S. Flying Service, Litchfield, Ill., was named vice president, and Lillard Hedden, Hedden Ag-Aviation, Pekin, Ill., was re-elected secretary-treasurer.

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Liability, Insurance, Poisoning Discussed at CAAA Meeting

Conclusion

IN his annual report to the CAAA, J. A. Montgomery Jr., association attorney, pointed out that the problems of aerial applicators are changing. Initially the principal problems were liability and drifting chemicals, but these problems aren't nearly as difficult now, he feels, since hearings on complaints are conducted with an open mind and not with everything stacked against the operator from the start as was the case five or six years ago.

He feels that the California Agricultural Aircraft Association has done much to educate the public on the problems of the applicator, but stressed the need for continuing public relations to overcome bad publicity resulting from inevitable law suits. He pointed out, however, that most aerial operators now realize their responsibilities, which has noticeably reduced the number of civil actions being filed. The farmer, too, has been educated to the need for aerial application which may be carried on by one of his neighbors and is not as quick to complain as previously. Another factor in favor of the aerial applicators are the trained investigators who have been developed to properly assess damage and place blame.

An insurance panel was held on Friday morning, presided over by Henry C. Moore, ex-officio. F. A. Gaylord explained how the CAAA group insurance protects both members and dependents and said twenty firms have already signed up. The plan will not go into effect, however, until a higher percentage of the membership joins. There are 1,000 potential members represented by the employees of CAAA operators and at least a 50 per cent participation is needed. He expressed hope that the plan will get going within a month.

George Hill of the Argonaut Insurance Company discussed the CAAA compensation program which has been in effect over a three year period. He said that results so far have been satisfactory, but not spectacular. Increased membership over the past year now makes the plan more attractive for workmen's compensation on a group basis.

G. F. Jacobson, Northwest Underwriters, discussed new problems in insurance arising from the use of toxic chemicals. He stressed the need for safety and urged all operators to wear the dogtags which his company makes available to them free of charge. The tags show the operator's blood type and give instructions to rush him to a hospital if found abnormal in any way because of the fact that he is an applicator of poisonous chemicals and may be suffering from poisoning.

Mr. Jacobson said that the diversification of crops in California, plus the longer operating season, heightens the risk of liability in suits arising from drift of chemicals. He discussed the recent 50 per cent rate raise which his company had been forced to put through on policies covering California operators and held out a possibility of future reduction if the California safety record is improved. The current loss record, he reported, is a high 81 per cent on California policies.

Stuart W. Turner, consulting agronomist, discussed California liability insurance claims. He gave the example of a big drift claim which was caused from spraying fourteen acres of ground with a Stearman when the operator should have used a ground rig. Claims during the past year resulting from the application of insecticide and fungicides were normal, he advised, as were claims arising from seeding operations and various noise claims. The major claims this past year came from defoliant spraying, resulting in drift claims and personal claims.

He explained the personal injury claims by the fact that operators often don't think of defoliants as toxic, but some people are bothered or claim to be bothered by them. Leakage of defoliants and other materials also is a problem, and he urged operators to keep a close check on their equipment. One operator, when questioned about a serious leakage of defoliant from his plane, explained that he didn't get any of the material on surrounding fields because he flew down the roads going to the job, but Mr. Turner commented that you can't go 90 miles per hour in a Stearman on some country roads.

Property damage claims along power lines also are increasing, according to Mr. Turner. He closed his talk with another warning to operators regarding defoliants and said that they should apply them just as though they were applying a very toxic material and use all the needed precautions.

Norman B. Akesson, Associate Agricultural Engineer, University of California, Davis, California, who has recently returned from an extended trip abroad to observe aerial application in other countries, gave a slide-illustrated talk on his travels. A complete report of Mr. Akesson's remarks starts on Page 56 of this issue.

In the final session, Lewis R. Hall, Division of Industrial Safety, discussed the reasons for the high insurance rates paid by applicators. He observed that big business spends much time and money on employee training to promote safety and obtain lower insurance rates. Aerial application, he re-

The first part of this report began on page 57 of the February issue.

minded, is also big business, and a similar program of safety, education, and safety enforcement should pay off.

He pointed out that ground crews, – loaders and flagmen – sustain 50 per cent of all injuries. Practically all of these accidents, he asserted, could be avoided with an enforced safety program. Principal violations of safety rules, he continued, are:

1. Improper storage of hazardous materials, and scattering of empty bags containing poisonous residue around the job.
2. Flag men exposed to drift without correct protective clothing.
3. Poor maintenance of equipment.
4. Flying across highways, without cutting dust, and dusting in the vicinity of schools.
5. Improper safety devices and clothing.
6. Poor lighting and ventilation around mixing operations.
7. Defective tools and equipment.
8. Improper use of chemicals.

R. V. Reynolds, Federal Aviation Agency, Los Angeles, discussed the new FAA, which was formed in January, 1959. He explained the difference between the new FAA and the CAA act of 1938, under which applicators have been operating. The FAA has assumed all CAA jobs, and Mr. Reynolds stressed the expanded FAA programs in accident investigation and flight control, which are now possible,–since FAA operates independently and under no other department of the government.

R. S. Ganelin, U. S. Public Health Service, Phoenix, Ariz., discussed common misconceptions about organic phosphates. The prime misconception is that members of unexposed populations living in the dusting area are being poisoned. The U. S. Public Health Service studies show no basis for this idea, or the related misconception that allergic diseases, such as asthma, are made worse among this same unexposed group.

Dr. Ganelin discussed misconceptions about symptoms of phosphate poisoning, and said small pupils are not necessarily a symptom of poisoning in every case. The converse isn't true either. He emphasized that early symptoms are mild, and easy to mistake until more serious exposure results.

Another important point mentioned was the practice of some pilots of taking atropine before dusting, to protect against exposure. He emphasized that, while atropine is used as a treatment for phosphate poisoning, it does not counteract the poison, but merely relieves the symptoms. When taken in advance, it may mask the symptoms until serious exposure results.

(*Continued on Page* 105)

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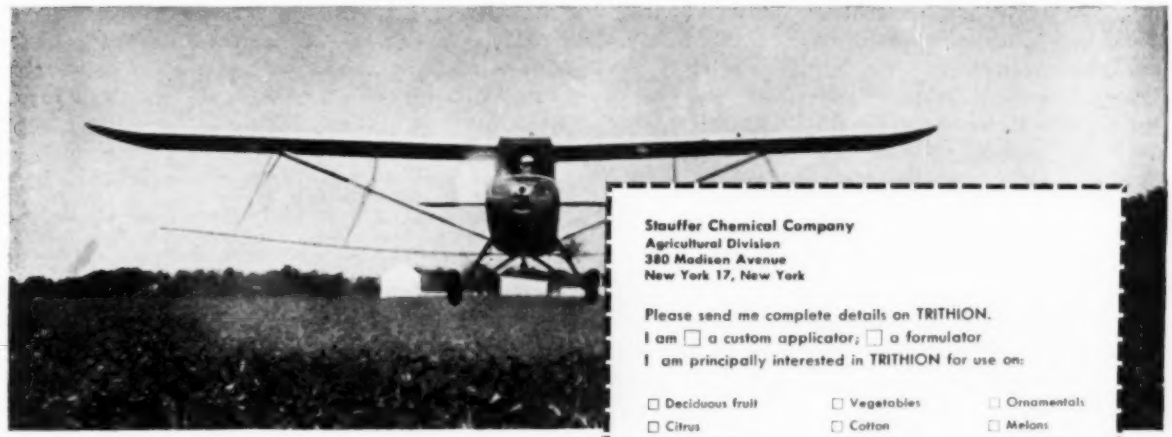

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600 Attend Illinois School For Custom Spray Operators

APPROXIMATELY 600 farmers, spray operators, and representatives from chemical and insecticide companies attended the 11th annual Illinois Custom Spray Operators' Training School January 28 and 29 at the University of Illinois in Urbana.

H. B. Petty, extension entomologist with the UI Agricultural Extension Service and the Illinois Natural History Survey, was chairman of the school which presented reports on just about every phase of research in weed control, pesticides, insecticides and spraying methods.

S. R. Aldrich, UI agronomist, started the program with a discussion of liquid fertilizers. According to Mr. Aldrich, liquid and dry mixed fertilizers perform about the same in most Illinois situations and where differences do occur, they do not consistently favor either form. So farmers may select either on the basis of cost per pound of nutrients, plus special considerations in handling, storing and applying the two forms, he said.

As to their availability in dry soil, it would seem logical that nutrients applied in a liquid form would be more readily available. In practice, however, there is only a slight measurable difference. The water in liquid fertilizers, when put on an acre basis is negligible. Dry fertilizer absorbs moisture and goes into solution unless the soil is very dry, Mr. Aldrich continued. Liquid fertilizers on the other hand, would soon lose moisture and crystallize out in a very dry soil.

No practical difference in rate of availability is expected in a moist soil because a significant amount of water-soluble nutrients in a dry fertilizer goes into solution within a matter of hours, or at most, a few days, he concluded.

"Invert" Emulsions

In the area of brush control, hazards caused by drift and volatility of 2,4-D and 2,4,5-T have caused much concern. However, Ralph Gantz, UI extension agronomist, reported that trial use of these chemicals as a different type spray have been promising in controlling drift. These new formulations are based on "invert" emulsions.

Two trials in Illinois this past year, said Mr. Gantz, showed that invert formulations effectively control weeds without damaging sensitive crops. In one county, a road bordered by tomato fields on both sides was sprayed with Inverton 245, an invert formulation made by the Dow Chemical Company. Even though a cross-wind was blowing, no tomato damage ever was detected.

Mr. Gantz continued by saying that invert formulations will not be usable in growing crops. The oil contained in the spray mixture causes too much contact burn for its selective use in corn and other crops.

Major possible areas for use would be on highways, utility and railroad right-of-ways passing through suburban areas, in front of farmsteads, or in the vicinity of any sensitive field crops.

M. B. Linn, UI plant pathologist, discussed in some detail the crop damage from drift and volatility of herbicides. Said Mr. Linn: "The situation with 2,4-D crop damage is so critical that if these losses continue, legislation may be

In an informal discussion are (left to right): Harold Geuther, Niagara Chemical Division, Wyoming; Vernon Anderson, ground spray operator from Newark; Earl Davies, ground spray operator, Mazon; Edward Sertl, G. S. Robins Co., St. Louis; and Steve Moore, extension entomologist with the university.

Left to right are: John Hawke, Shell Chemical Corp., St. Louis; Lloyd Good, Rantoul; Norman Reeder, **Capper's Farmer** magazine; K. P. Bucholtz, University of Wisconsin agronomist who spoke at the spray school; and H. B. Petty, extension entomologist with the U of Illinois and the Natural History Survey.

introduced to (1) license the use of 2,4-D and perhaps other farm chemicals, (2) prohibit the use of only the ester formulations of 2,4-D *or* (3) prohibit the use of all forms of 2,4-D."

To prevent injury from 2,4-D, Mr. Linn advised not using the high-volatile formulations of 2,4-D under any circumstances. These include the methyl, ethyl, propyl, butyl, and amyl or pentyl series. Mr. Linn continued by saying that it would be a grave mistake to assume that low-volatile or amine formulations of 2,4-D are entirely safe. "The mists from these forms may drift for several hundred yards and injure sensitive plants. Therefore do not use any kind of 2,4-D, regardless of formulations, within ½-mile of a susceptible crop."

Roadside Weed Control

E. P. Sylwester, extension botanist and plant pathologist from Iowa State College, was one of three out-of-state speakers on the school's program. Mr. Sylwester presented talks on cleaning up highways and roadsides with herbicides, and Canada thistle control.

For controlling roadside weeds, Mr. Sylwester reported that 2,4-D, preferably in the ester form, gives best results. He also stated that roadside weeds should be sprayed when they are growing—not when they're old and tough. Often in beginning programs it's necessary

Among the school's "students" are (left to right): Raymond C. Weber, Weber Sanitary Systems, St. Charles; Frank Kadleck, pest control operator from Red Bud; and Wayne Blystone, ground sprayer from Odell.

to spray roadsides and fencerows twice a year. After that, one well-timed application each year will be sufficient.

For killing brush, Sylwester said that mixtures of 2,4-D and 2,4,5-T are used more extensively than 2,4,5-T alone. With repeated treatment, few trees and brush can survive. However, where resistant species occur, 2,4,5-T may give better results.

Effects of Biting Flies

Biting flies can cause a 15 to 25 percent loss in milk production! That was the key point in a talk presented by Steve Moore on effects of biting flies on milk and beef production. Mr. Moore is an extension entomologist with the UI and the Illinois Natural History Survey.

In dollars and cents, this production loss can easily add up to $10 per cow during the summer!

Horn flies, stable flies and horse flies are the three most important kinds of biting flies that attack livestock in Illinois. The small horn-fly is the most numerous; the large horse-fly the least numerous; and the middle-sized stable fly the most injurious.

Mr. Moore said that good sanitation is absolutely necessary to control these flies. To supplement sanitation measures, he suggested spraying cattle in pasture or making a back-rubber available. For spraying, Tabatrex and R-326 give excellent results. If hornflies are the only problem though, a methoxychlor dust gives satisfactory results.

A back-rubber with 5 percent toxaphene or methoxychlor in oil protects against hornflies but not stable flies or horseflies. During the winter months this same device will help to control lice, Mr. Moore continued. However, he warned to not allow dairy animals to use the back-rubber 30 rays before freshening, or beef cattle 30 days before slaughtering.

1958 Simazine Results

In 1956 and 1957, Simazine gave almost perfect results in controlling weeds in Illinois cornfields. But in 1958, it worked only about half the time. This report was given by Fred W. Slife, UI crops

(*Continued on Page* 107)

H. M. Gunderson (left), Iowa State extension entomologist, discusses mosquito control with (left to right): Jack Kemp, Kemp Spray Service, Belvidere; Maurice Schelhardt, Stokely-VanCamp Co., Indianapolis; Herbert Stam, Stam Spray Service, Watseka; and Bob Danforth, Danforth Aerial Sprayers, Monmouth.

John Bigger (left), entomologist with the Illinois Natural History Survey, Urbana, Ill.; is shown with (left to right): Jack Bonnevie, Goodlife Chemical Co., Effingham, Ill.; Jack Bigger, Boone Soil Service, Belvidere, Ill.; Merle Pine, spray operator from Lee, Ill.; and Irving Shaw, Oneida, Ill.

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PEST ROUNDUP

By Kelvin Dorward

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head — Survey & Detection Operations, Plant Pest Control Division, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the U. S.

Boll Weevil Hibernation Off

PREVIOUSLY reported in this magazine were fall boll weevil hibernation counts from the Carolinas, Virginia and Louisiana. Counts from these areas were down from those of the 1957 fall survey. The same is true for Georgia, Mississippi and Tennessee.

To determine the number of cotton boll weevils going into hibernation, surface woods trash adjacent to cotton fields is collected and examined. In Georgia, the average number of live weevils per acre of surface trash found in the fall of 1958 was 1,133. This is lower than the 8-year average of 1,279 and the 1957 average of 2,081. Area averages for 1958 and 1957 in Georgia were as follows: Northwest Georgia 744 and 1,113; north central 2,178 and 5,034; east central 387 and 1,791 and south 147 and 387, live weevils per acre of surface trash.

Boll weevil hibernation counts in Mississippi made in the fall of 1958 were lower than those made in the fall of 1957. The average number of hibernating weevils per acre of trash for the State was 3,792 as compared with 6,716 for 1957 and 2,091 for 1956. For study purposes the samples were collected in four designated areas. The lower delta area produced an average count of 4,242 live weevils per acre in last fall's survey compared with 5,243 found in the 1957 fall survey. In the central delta area, 4,909 hibernating weevils were found in 1958 and 6,269 in 1957. North delta average counts were 2,960 in 1958 compared with 11,264 and the hill section had a 1958 average count of 3,057 compared with 4,087.

McNairy County, Tennessee 1958 fall boll weevil hibernation survey showed the average number of live weevils per acre of woods trash to be 1,214 compared with 2,365 in the 1957 fall survey. McNairy County represents the heaviest infested area of Tennessee.

Corn Borer Counts Down

Surveys conducted by agricultural agencies in 25 States during the late summer and fall of 1958 showed the average fall population of European corn borer larvae in the field to be considerably below that of 1957. (See abundance map). For the reporting area as a whole the count for 1958 was 94 borers per 100 plants compared with 162 in 1957. In 1956 the fall counts averaged 112. However, weather conditions during early stages of borer development will largely determine the 1959 population.

The decreases were most notable in Iowa, Missouri and South Dakota where the number of borers per 100 plants averaged 166, 109 and 83 compared with 419, 399 and 313 in 1957. Populations in North Dakota showed a marked increase, with the 1958 counts per 100 plants being 179 compared with 93 in 1957. Populations in the other Central States were approximately the same as in 1957.

European corn borer populations were somewhat varied in the Eastern States. Substantial increases were recorded in Delaware, New Jersey and Virginia. They were 249, 169 and 252 respectively in 1958 compared with 90, 89 and 117 borers per 100 plants in 1957. A drastic decrease was noted in Rhode Island, with the counts being 30 in 1958 and 312 in 1957. The average for the 10 reporting Eastern States as a group was slightly higher than the counts recorded in 1957.

The principal spread of the European corn borer continued south and southwest in 1958. Counties and parishes reported in 1958 as being infested for the first time were 15 in Alabama, 24 in Arkansas, 6 in Georgia, 5 in Louisiana, 2 in Missouri, 2 in North Carolina and 4 in West Virginia.

In Alabama the highest counts were recorded in Marshall County for the second straight year, 402 borers per 100 plants compared with 276 in 1957. In Arkansas the highest counts were in St. Francis County, being 184. Surry County was high in North Carolina, with 132 borers per 100 plants. State averages were low however, being 75 for Alabama, 39 for Arkansas and 23 for North Carolina.

Grasshopper Population Lower

Cooperative Federal-State adult grasshopper surveys conducted during late summer and fall 1958 indicate that in 1959 grasshoppers will likely be more widespread than last year but infestations may be lighter. The adult survey shows economic populations on over 22 million acres of rangeland in 15 Western and Mid-Western States. The 1957 fall adult survey showed a potential infestation for 1958 on only 18 million acres. There were

(*Continued on Page* 68)

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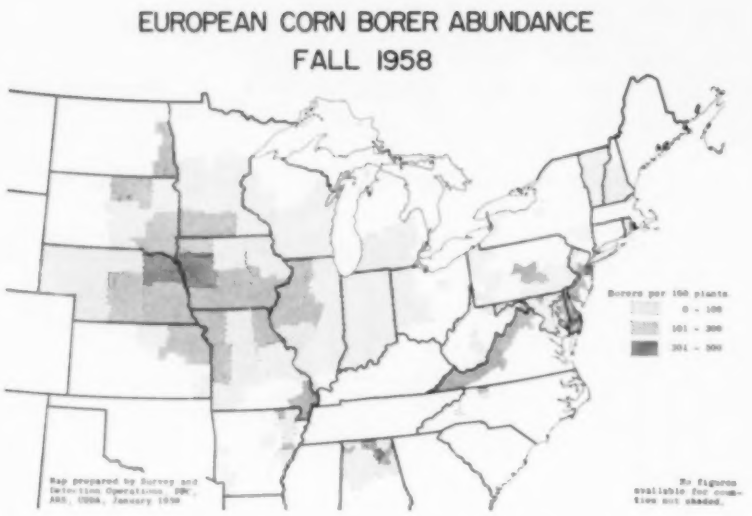


PEST ROUNDUP

(*From Page* 65)

many areas carrying very abundant populations in the '57 survey, whereas the 1958 fall survey shows most of the acreage to carry only light or moderate infestations.

Largest rangeland acreages with economic populations are found in Colorado, California, Texas, Oklahoma and Montana, with over 5½ million, 4½ million, 3 million, 2½ million and 2 million acres respectively. States with the largest amount of acreage carrying a population rated as very abundant are Colorado, Montana and California.

The cropland infestation in general is slightly higher than that indicated for 1958. The principal cropland area having a very abundant fall adult population is in central Wisconsin.

Late in 1958 several areas were spot-sampled to determine the number of eggs laid by the adult grasshoppers. Generally, these checks bore out the findings of the adult survey, but some reduction was noted in Oklahoma and Texas. Weather and other natural factors will of course affect the number of eggs that hatch this spring as well as the number of early instar nymphs that survive. Nymphal surveys to be made early in the season will actually tell the extent to which controls will be needed.

Chinch Bug Survey

The annual chinch bug hibernation survey conducted in the fall and winter of 1958 showed populations generally lower than those found in 1957. In Oklahoma 39 counties recorded lower populations, 30 the same and only 8 showed an increased rating as compared with 1957. Other states with economic populations, but generally lower than in 1957, include Nebraska, Kansas, Missouri, Illinois, Indiana and Arkansas. Survey of 16 southern Wisconsin counties showed populations to be noneconomic. In Iowa, too, populations during the season were of noneconomic importance.★★

NATA Sets Convention Dates

The National Aviation Trades Association will hold its 20th annual convention in New Orleans, La., November 16 to 20, 1959.

The meeting will begin with a preflight party on the 16th and sessions will start early on the 17th and continue through the 20th. The NATA executive committee will meet on the 16th and the 21st.

•

Form Australian Assn.

A Federal body of aerial operators has been formed that covers the 46 aerial firms in Australia.

Aerial Equipment Folders

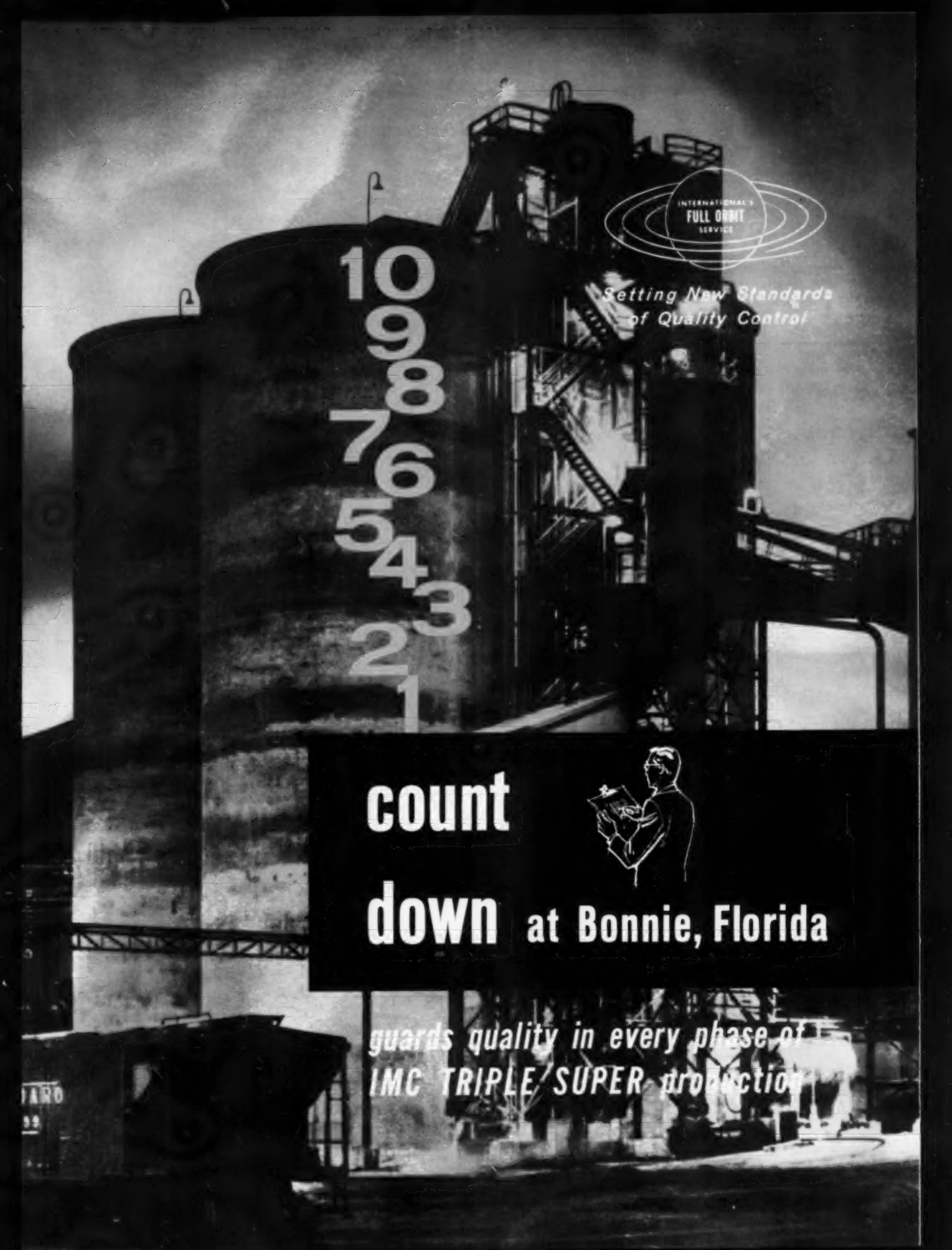
At the recent meeting of the California Agricultural Aviation Association in Sacramento, a number of companies distributed folders on aircraft and spraying equipment. Among the firms represented was the Winslow Aerofilter Corp., Oakland, Calif., which offers the CP Full-Flow Aerofilter for light aircraft and helicopters.

Eonair, Inc., Bakersfield, Calif., displayed its Eonite aircraft covering and the Harang Engineering Co., San Francisco, presented literature on Nutra-Sol, a material for flushing spray equipment before and after use to neutralize chemicals.

Among the aircraft manufacturers on hand were the Kellett Aircraft Corp., Willow Grove, Pa., with descriptive literature on the Kellett autogiro; the Helicopter Division of Republic Aviation Corp., Farmingdale, L. I., with information about its turbine powered helicopter, the Alouette; and the Agricultural Aircraft Division of the Grumman Aircraft Engineering Corp., Bethpage, N. Y., with a folder on the Grumman Ag-Cat. Also, Transland Aircraft, a division of Hi-Shear Rivet Tool Co., Torrance, Calif., displayed the Ag-2 farm and forest plane. Blackfield Aero Industries, Oakland, Calif., made available information on the Champion Sky-Trac airplane that can be used for agricultural spraying.

Pickell & Associates, Los Angeles, offered a folder on its agricultural aircraft pumps, control valves, tanks, and hoppers. W. P. Fuller & Co., displayed the Fuller Aircraft Finishes and Hawthorne Aircraft Industries, Lucerne Valley, Calif., presented information on its complete line of Stearman PT-17 parts. Harold L. Root, Visalia, Calif., displayed the Model No. 55 pump for agricultural aircraft. An informative booklet displayed by the California Division of Industrial Safety urges handlers of spray materials to observe all safety rules.

The Simplex Co., Portland, distributed literature on pumps.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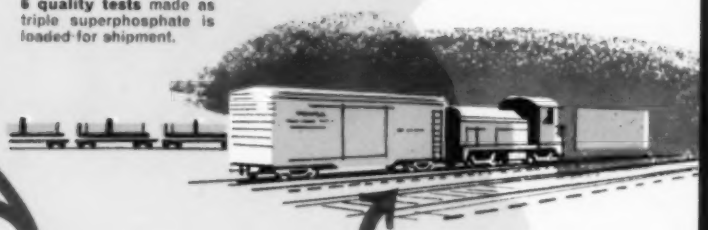

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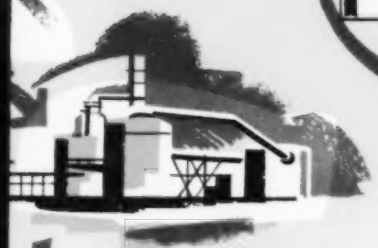

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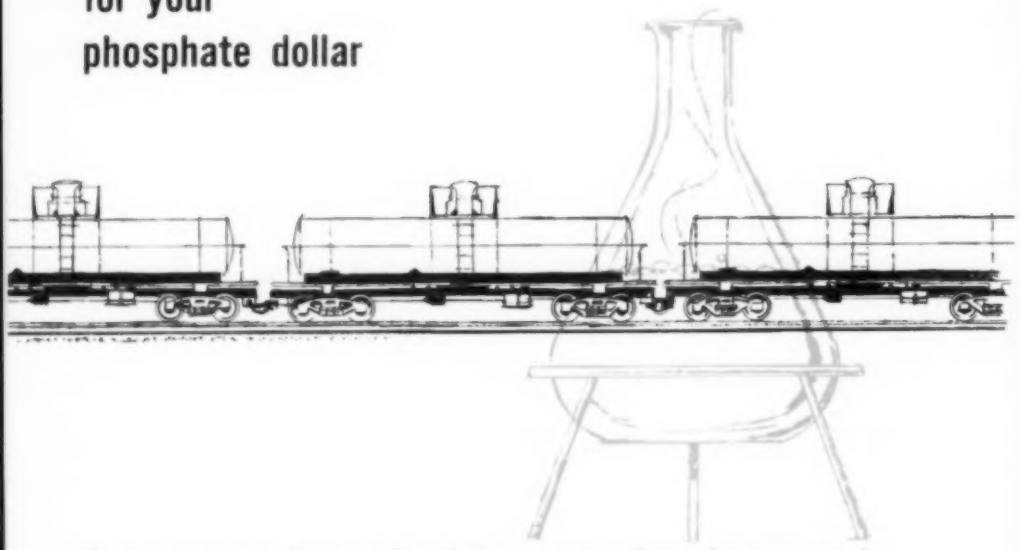

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WASHINGTON REPORT

By Donald Lerch

AN important "first" has been chalked up by the National Plant Food Institute with the recent pilot fertilizer salesmen's training school held in Columbus, Ohio. NPFI staff members were astounded by an audience of some 180 Ohio fertilizer salesmen and sales managers, instead of the 60 to 80 originally expected.

The one-day course concentrated on what fertilizer customers are like, how you motivate them to buy, and what tools are available from NPFI, and from state sources such as Ohio State University to assist fertilizer sales. Going beyond the classroom lecture technique, sound-slide films were used to dramatize effective techniques of selling.

NPFI, of course has been producing sales aids such as booklets, posters, and motion pictures for years. The pilot course in Columbus, however, was the Institute's first major effort in sales training. The tremendous response to the pilot sales training course bodes well for increased fertilizer sales in the future.

That sales training may become a major program of the Institute is indicated by the recent publication of a 220-page "Fertilizer Salesman's Handbook." Over two year's work went into the handbook. In effect, it provides a short course on agronomy, soil science, and how to sell fertilizer. It is in loose-leaf form so it can be kept up to date as NPFI puts out new sales materials.

AC

In a well-thought-out move, the National Agricultural Chemicals Association has let Congress know that the pesticide industry will be out for two changes in federal laws.

One change would eliminate charges now made by the Food and Drug Administration for the establishment of a pesticide tolerance. The other would bring defoliants, desiccants and plant regulators under the Federal Insecticide, Fungicide and Rodenticide Act.

NAC put Congress and others on notice that efforts will be made to gain this legislation during this Congress by publishing a series of NAC viewpoints on legislative and other important issues that face the Pesticide industry. The viewpoints went to key members of Congress and state officials as well as to NAC members.

Other viewpoints expressed included: 1) that pesticides should be exempted from state pharmacy and poison laws, 2) that states should not get into the pesticide business to buy at "wholesale" and resell to farmers "at cost," 3) that efforts to improve proper use of pesticides should be done by education rather than by restrictive legislation, 4) that pesticides should be exempted from state sales and use taxes, 5) that sales of pesticides in broken packages should be prohibited, 6) that pesticides should continue to be exempted from federal and state hazardous substances laws, 7) that NAC will continue to support the proper use of pesticides in pest eradication programs, and 8) NAC will continue to expand its efforts to give the public factual information on pesticides and their use.

Though nothing startlingly new is included in the list, putting NAC viewpoints on public record for all to read marks a step forward in business statesmanship in the pesticide industry.

AC

It is no longer any secret that Senator Estes Kefauver plans to spearhead an investigation of pricing in the fertilizer and farm machinery industries later this year.

The probe by the Senate Antitrust and Monopoly Subcommittee is part of an "administered prices" investigation begun two years ago. While the fertilizer and farm machinery industries are on the list for investigation, indications now are that they will not be called in the immediate future.

The promise that fertilizer and farm machinery industries will be investigated, however, indicates that representatives in these fields had better get their facts and interpretations ready now—both for presentation to the Subcommittee, when they are called, and the public via the mass media.

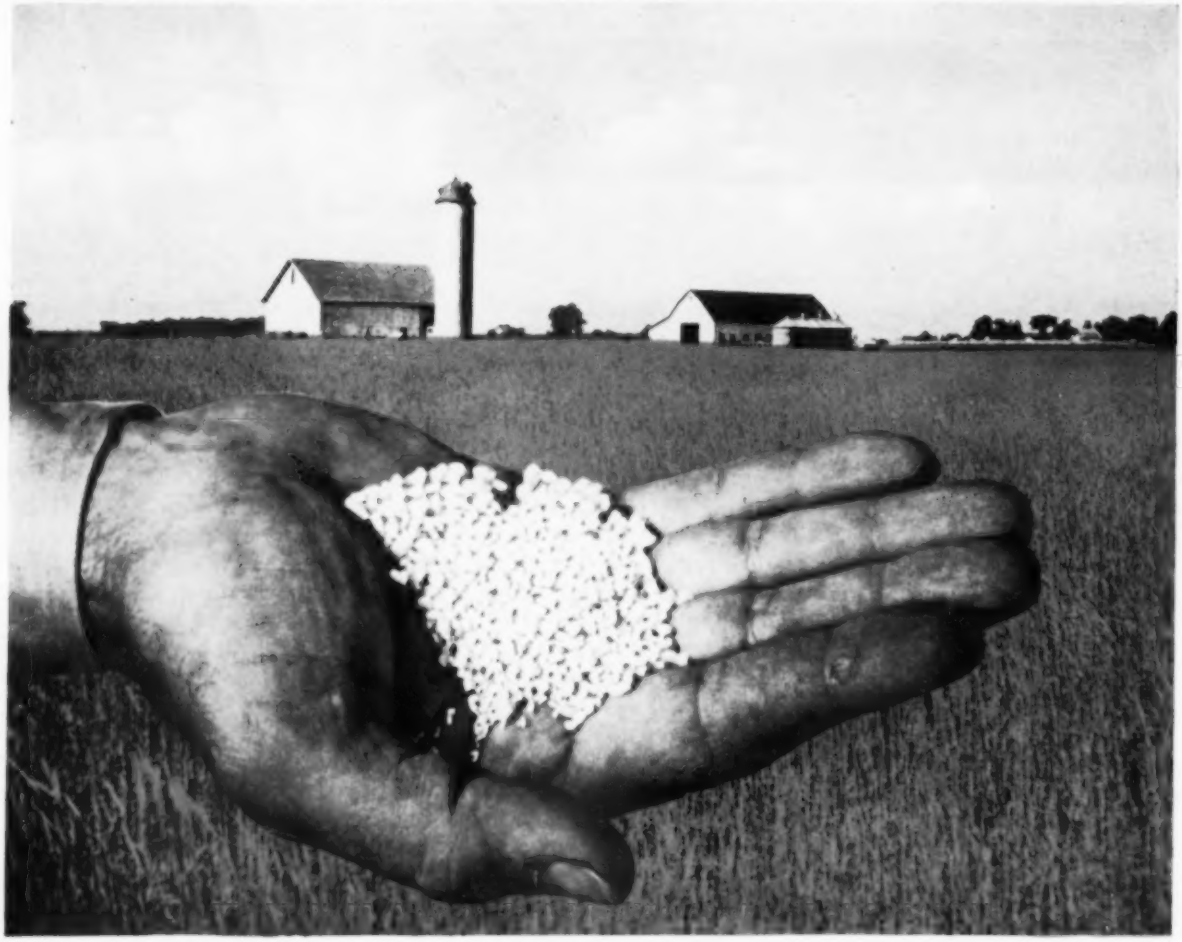
Though not yet generally recognized by business groups, testimony before Congressional investigating committees can be used as an effective platform for addressing customers and the general public. A few alert businesses are beginning to take advantage of this opportunity to tell the public what a good job their businesses are doing in serving the public interest.

AC

Although insects and diseases cause nine times the mortality to

(*Continued on Page* 118)

Advertisements like this in full color are appearing every month during the fertilizer season in Farm Journal, Farm & Ranch, Progressive Farmer, and Capper's Farmer.



Hi-D...the only ammonium nitrate that's granular!

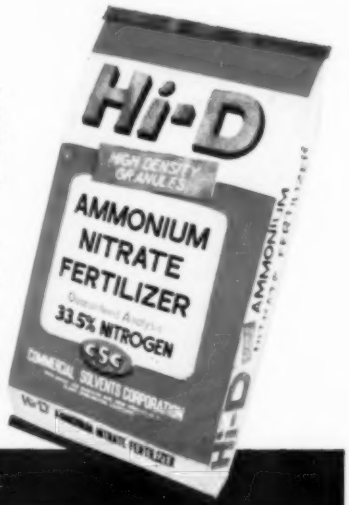
the helping hand that boosts your yield

Give your land the helping hand of Hi-D. See for yourself why Hi-D is better than any other ammonium nitrate.

Hi-D handles so well—in storage and in spreading. *Only Hi-D is granular.* High in density, Hi-D is super dry—has less tendency to pick up moisture prior to application even under humid field conditions. Result: Hi-D always flows freely—doesn't gum-up—won't clog, cake or bridge in the spreader. And still another advantage, you can get up to 20% more ammonium nitrate in the hopper to reduce loading stops.

Hi-D contains 33.5% of available nitrogen. This crop-boosting nitrogen comes in two equal "servings"—your crops get half *nitrate* nitrogen for vigorous early growth and half *ammonia* nitrogen for sustained follow-up feeding.

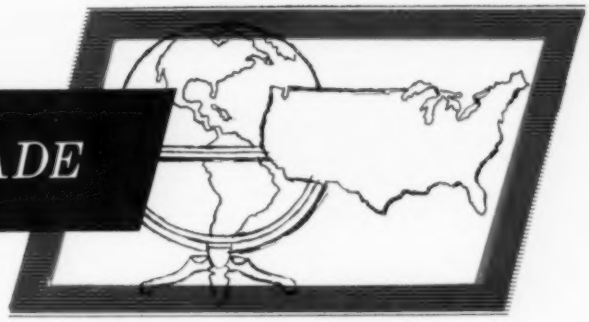
This year, let Hi-D help boost your yield. but remember—sound management calls first for soil testing, a liming program if needed, and the necessary balanced mixed fertilizer. Then, a supplementary feeding of nitrogen—the heart of the harvest. Make it Hi-D ammonium nitrate . . . see your dealer.



THE BEST SOLID NITROGEN!

COMMERCIAL SOLVENTS CORPORATION • OFFICES IN ATLANTA, CHICAGO, CINCINNATI, KANSAS CITY, ST. LOUIS, STERLINGTON, LA.

NEWS about the TRADE



AgChem Manager For Pennsalt

Appointment of J. Drake Watson to the position of general manager, Pennsalt Agricultural Chemicals was announced recently by Fred C. Shanaman, president of Pennsalt of Washington Division, Pennsalt Chemicals Corporation, Tacoma, Wash.

Mr. Watson, a graduate of Clemson College and Virginia Polytechnic Institute in agronomy, and a veteran of World War II, joined Pennsalt Agricultural Chemicals in 1948 after several years' experience at southern agricultural experiment stations. He served as a technical sales representative and later as district manager with offices at Montgomery, Ala. After military duty during the Korean conflict, Mr. Watson assumed sales manager duties for a southern district and in 1954 became administrative assistant to the general manager, Agricultural Chemicals. For the past two years, he has been administrative assistant to the president, as well as handling the export sales.

•

Three Named By Bemis

R. E. Hartig, manager of the Bemis Bag Co.'s Flemington, N. J., plant, has been transferred to the product development unit of the company's general sales department, St. Louis.

He is succeeded by P. J. Ferree, formerly superintendent of the Bemis Houston plant. The company also announced the appointment of Raymond A. Parr as a representative in the St. Louis product development unit.

•

Dowpon Sampling Program

A promotion program based on trial of the product is being launched by the Dow Chemical Company, Midland, Mich. this year. The program will support the sale of Dowpon as a grass control agent.

Top feature in the promotion is the offer of free trial packages of Dowpon through Dow dealers. All dealers signing up for the program will be stocked with two ounce packets of Dowpon to be given away to customers.

The whole program is aimed at building traffic for the farm chemical dealer. The aim is to improve future business by acquainting more farmers with agricultural chemicals.

•

Hercules Offers UN-32

The Hercules Powder Co., Wilmington, Del., has announced its entrance into the production of urea ammonium nitrate, high-analysis fertilizer solution, UN-32, with the publication of a descriptive booklet on the product.

UN-32 is a urea nitrate solution containing 32 per cent nitrogen.

•

CSC President Resigns

The president and three other directors of the Commercial Solvents Corp., New York, are reported to have resigned as a result of differences of opinion with major stockholders of the corporation, according to a story in the *Journal of Commerce*, Feb. 17.

J. Albert Woods, a director of Commercial Solvents since 1949 and president since 1950, will continue to serve in a consultative capacity until the end of 1962, the paper said. Maynard C. Wheeler, senior vice president and a director since 1950, has been elected acting president.

Three directors whose terms expire this year, announced that they would not be candidates for re-election. They are; William E. S. Griswold Sr., Henry V. B. Smith, and James A. McConnell.

Form New Company

Solar Nitrogen Chemicals, Inc., has been formed by the Standard Oil Co. (Ohio) and the Atlas Powder Co. The new company, jointly owned by the parent companies, will engage in the manufacture and sale of agricultural and industrial chemicals. It will acquire all of Sohio's present ammonia and related petrochemical facilities at Lima, Ohio. Sohio will continue to operate the plant and to act as sales agent for the new company.

Edward F. Morrill, president of Sohio, has been named president of Solar Nitrogen Chemicals and Edward J. Goett, executive vice president of the Atlas Powder Co. has been elected vice president.

•

Forms Research Firm

J. B. Skaptason has formed the Bio-Search and Development Co. in Kansas City, Mo., to offer laboratory service in biology, toxicology, and chemistry of pesticides and related products.

Dr. Skaptason said, in announcing the formation of the company, that it is equipped to offer all the necessary services, such as patent and literature searches, market information, formulation and packaging assistance, analytical and process services, and bio-assay for control purposes. Dr. Skaptason formerly was manager of agricultural product development for the Spencer Chemical Co., Kansas City.

MY FERTILIZER SALES INCREASED 55%

"I have set myself up on quality . . . quality mixed fertilizer and a quality nitrogen . . . John Deere Vitrea. For me, quality and service offer the best approach to selling fertilizer. It gets me out of the rat race of price cutting . . . makes me more profit.

"Quality products bring me more repeat business and at the same time many new customers. This past season my fertilizer sales were up 55%.

"Our soil testing, mapping, farm planning and other services help get customers on a good program . . . once they are on such a program they stay *good* customers.

"Some of the things I particularly like about handling Vitrea is the excellent service I get on deliveries — furthermore I know I can consistently depend on getting highest quality. And too, Vitrea bags always arrive in good shape with less breakage than other types I have previously handled.

"You can bet Vitrea will play a big part in my profit picture again this year."

RALPH SNELLING
BOSWELL, IND.

RALPH SNELLING
SNELLING FARM SERVICE
BOSWELL, INDIANA

With **John Deere** ViTREA — 45% nitrogen from urea — you can depend on getting the quality and service that is sure to please your customers and boost your profits.

TODAY, ViTREA IS A BETTER BUY THAN EVER!
ORDER NOW!

Grand Rapids Chemical Division of DEERE & COMPANY

Assistant Sales Manager

Harry Sidles has been named assistant sales manager of the agricultural chemicals division of the Velsicol Chemical Corp., Chicago. He had been with the Rohm & Haas Co., where he was responsible for nationwide sales of agricultural chemicals. Mr. Sidles' Velsicol appointment was made known when the company announced a general expansion and realignment of its agricultural chemical sales organization.

•

End Merger Negotiations

Merger negotiations between the Smith-Douglass Co., Norfolk, Va., and the Wilson & Toomer Fertilizer Co., Jacksonville, Fla., first announced last September, have been terminated.

Agreement could not be made on terms satisfactory to both boards of directors according to a joint statement issued by the companies.

•

CFA Tells Meeting Plans

The California Fertilizer Association has announced that its 36th Annual Convention will be held Nov. 9, 10 and 11, 1959, at the Fairmont Hotel, on Nob Hill, in San Francisco.

The CFA convention is held in northern California in odd-numbered years and in southern California in even numbered years, and the specific location is chosen by action of the board of directors.

Thomas Fleischman of St. Regis Paper Company, San Francisco, is chairman of the convention program committee.

•

Joseph E. Kennedy Dies

Joseph E. Kennedy, founder and chairman of the board of the Kennedy Van Saun Mfg. & Eng. Corp., New York and Danville, Pa., died at his home in New York on January 9. He was 95 years old.

Mr. Kennedy started his business career 75 years ago when he opened a hardware and farm implement business in Grand Rapids, Mich. He had over 1,000 patents to his name.

Thompson-Hayward Officials

Paul L. Lonnecker (right) has been appointed vice president — general sales manager of the Thompson-Hayward Chemical Co., Kansas City, Mo. He has been with the company for 18 years.

At the same time, Ervin W. Segebrecht (left) was named administrative assistant to the executive vice president and to the vice president-sales.

Mr. Segebrecht formerly was associated with the Spencer Chemical Co. and the Armour Chemical Division.

•

Kentucky Fertilizer Conf.

The annual Kentucky Fertilizer Conference is scheduled to be held July 29, 1959, at the Guignol Theater on the University of Kentucky campus in Lexington.

•

Southern Weed Group Elects

More than 300 delegates to the 12th annual meeting of the Southern Weed Conference, Jan. 22 to 24, at Shreveport, La., elected V. S. Searcy, Alabama Polytechnic Institute, Auburn, as their pres. for '59.

Other officers elected to serve with Mr. Searcy were R. A. Darrow, USDA, Texas Agricultural Experiment Station, College Station, Texas, vice-president; W. K. Porter Jr., Louisiana State University, Baton Rouge, secretary-treasurer; and R. E. Frans, University of Arkansas, Fayetteville, secretary-treasurer-elect.

Elected as members at large to the conference's executive committee were H. E. Rea, Texas Agricultural Experiment Station, College Station; E. O. Burt, University of Florida, Gainesville; and R. P. Upchurch, North Carolina State College, Raleigh.

More than 70 papers relating to research in the field of weed control were read at the conference. The next meeting of the Southern Weed Conference will be held at the Buena Vista Hotel, Biloxi, Mississippi, January 20-22, 1960.

Symposium on Insect Resistance Problem Planned For Oct., 1959

HIGH-RANKING representatives of the nation's chemical industry and governmental research units met at the University of California, Riverside, in February to plan a symposium on research dealing with the problem of insect resistance to insecticides.

The symposium, planned for the third week in October in Washington, D. C., will be attended by members of the National Agricultural Chemicals Association and the Entomological Society of America.

Urgency of such a meeting of top entomological brains on the resistance problem was stressed by the planning committee, according to Chairman Robert L. Metcalf of the UCR department of entomology, who with Citrus Experiment Station Director, A. M. Boyce, was a host to the visiting scientists.

Among points brought out by conferees were these:

1—Resistance in important agricultural pests is having a serious impact on farmers by decreasing the efficiency of insect control and on the agricultural chemical industry by undoing years of research and spending that have gone into current products.

2—Better management will be needed in the use of insecticides to slow or stop the trend toward resistance.

3—New and more powerful chemical weapons must be found and money for the necessary research must be provided.

4—There is an urgent need for accurate information on the levels of susceptibility of important pests to standard insecticides and for standard test methods to determine resistance. These are necessary so that the onset of resistance to an insecticide may be determined before it reaches serious proportions.

5—Of fundamental importance is the need for basic work on the mode of action and processes of resistance to insecticides, so that chemical companies can hope to proceed on a rational basis in the development of new materials with some expectation of a prolonged period of use.

•

Penick Consolidates

The domestic operating activities of S. B. Penick & Co., New York, have been consolidated into three divisions.

The NYQ Chemical Division replaces the New York Quinine & Chemical Works Division.

The Botanical and Allied Products Division encompasses the company's activities in botanicals and their derivatives; drug extracts; essential oils, flavor and perfume compounds; gums, spices, etc.

The Farm Chemical and Insecticide Division has added feed grade antibiotics to its previous list of specialized chemical and insecticide items.

Research Symposium

From left foreground: F. W. Hatch, Monsanto Chemical Co.; J. T. Thurston, American Cyanamid Co.; E. F. Knipling, U.S.D.A.; C. W. Kearns, Shell Chemical Co.; H. T. Reynolds, UCR; K. D. Quarterman, Health, Education, Welfare; R. L. Metcalf, UCR; A. W. A. Brown, Univ. of Western Ontario; R. B. March, UCR; J. E. Johnson, Dow Chemical; C. C. Alexander, Geigy; A. M. Boyce, Citrus Exp. Station.

Addresses NMSU Conference

The Agricultural Chemicals Conference at New Mexico State University, State College, New Mex., Feb. 5, featured an address by Stuart R. Race, assistant professor of entomology.

He summarized insect investigations at the NMSU Experiment Station and said that spotted alfalfa aphids were controlled effectively by experimental systemic insecticides, Thimet and Disyston, applied as granules to 2 and 3-year-old alfalfa plants at the rate of one pound per acre. Aphid parasites and predators, he said, did not appear to be adversely affected by the treatments.

Using the same chemicals in cotton insect investigations, the entomologist said good control was given to early season thrips.

In another experiment, New Mexico 16 (zia) and Lahontan alfalfa varieties continued to display a high degree of resistance to spotted alfalfa aphid attack when compared with the New Mexico Common and New Mexico 11-1 varieties, Mr. Race reported.

Other conference speakers from the NMSU staff included: Dr. G. L. Neilson, survey entomologist, division of plant industry; A. S. Curry, associate director, agricultural experiment station; Dr. J. G. Watts, head of the botany and entomology department; R. W. Ludwick, chief of the Division of Non-Food Inspection; Dr. J. L. Stallings, assistant professor, agricultural economics; B. C. Williams, assistant professor of soils; Dr. D. T. Sullivan, assistant in horticulture; G. B. Hoff, extension agronomist; Dr. R. W. Leamer, soil scientist with the agricultural research service; Dr. T. E. Smith, associate professor, plant pathology; Dr. S. S. Szabo, assistant in agronomy; and Dr. C. R. Maier, assistant professor, plant pathology.

Other speakers included Dr. R. L. Beacher, southern regional director, NPFI, Fayetteville, Ark., and Seldon Baker, Agricultural Servies, Deming, Ark.

•

Seeks Contact With U. S. Firm

Produtos Organicos, Lda., Lourenzo Marques, Portuguese East Africa, is anxious to associate itself with a pesticides manufacturing firm in the United States. The African firm is the only manufacturer of pesticides in its territory and is interested in technical and contentrated materials as well as financing.

Dr. P. J. Leyendecker, (left) assistant dean of agriculture at New Mexico State University, confers with (left to right): Danny Provencio, Farm Supply Co., Las Cruces; Clayborn Wayne, Farmers Market and Supply Co., Hatch; and B. F. Archer, John Deere Co. Hatch. Bottom picture shows (left to right): Richard G. Marek, county agent; R. W. Ludwick, N.M.S.U. department of agriculture; Jim Craft, Craft Fertilizer Co., Carlsbad; and Sam Lovejoy, Lovejoy Flying Service, Carlsbad.

NAC Announces Dates

The 26th annual meeting of the National Agricultural Chemicals Association will be held at the French Lick - Sheraton Hotel, French Lick, Indiana, Oct. 21-23.

•

Nitrogen Plant in Tampa

The Florida Nitrogen Co., a new and wholly owned subsidiary of the Southern Nitrogen Co., Savannah, Ga., is planning to build a nitrogen plant in Tampa, Fla. In connection with this, Southern Nitrogen has announced an expansion of its ammonia production facilities at Savannah to supply the Tampa plant.

George V. Taylor, president of the Florida Nitrogen Co., said that the Tampa plant will include facilities for the production of solid 20.5 per cent lime nitrate and a full line of nitrogen solutions.

•

Two Named By Hooker

Carl I. Gochenour has been appointed general manager—product development for the Hooker Chemical Corp., Niagara Falls, N. Y. He had been manager of product development—chemicals.

At the same time, the company named Dr. Thonet C. Dauphine to a position in the general development department, specializing in the area of economic development.

•

Malathion Uses Cleared

Malathion, an American Cyanamid Co. insecticide, has been cleared for use on two additional commercial crops and for more widespread use on animals.

A malathion bait spray or dust combining malathion and unsulfurized molasses has been cleared for use against dried fruit beetles and vinegar flies on figs. Another new claim covers the use of malathion to control aphids on okra.

Malathion also has been cleared for use on sheep and goats for the control of lice, ticks, and keds. The insecticide already is in general use for the control of external pests on poultry, hogs, cattle, dogs and cats.

IF YOU'RE IN THIS AREA...

MAKE U.S.I. YOUR SOURCE FOR

AMMONIA • NITROGEN SOLUTIONS • PHOSPHATIC FERTILIZER SOLUTION • SULFURIC ACID

If you make fertilizers in the area shown on the map above, a U.S.I. plant is within fast-delivery and convenient-servicing distance of your operation.

A huge plant at Tuscola, Ill. is able and eager to supply all your requirements of these agricultural chemicals:—

NITROGEN — Available as anhydrous or aqua ammonia, plus 16 types of nitrogen solutions. These include urea types.

PHOSPHORUS — U.S.I.'s Phosphatic Fertilizer Solution (wet process phosphoric acid, 52-53% P_2O_5) is helping many manufacturers make solid fertilizers at lower cost. Let the U.S.I. representative show you how.

SULFURIC ACID — All concentrations including oleum, also good spent acid of fertilizer quality. Three U.S.I. plants, at DeSoto, Kansas; Dubuque, Iowa and Tuscola, Illinois produce sulfuric acid.

Remember, too, that Technical Service is more than a catch phrase at U.S.I. For well-informed help on materials, equipment or formulations, call collect, Heavy Chemicals Sales, U.S.I. — New York office — OXford 7-0700.

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Heavy Chemicals Sales Dept.
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Please place me on your mailing list to receive future information on U.S.I. heavy chemicals.

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☐ I manufacture _____

I use—or plan to use:

☐ Ammonia, Nitrogen Solutions ☐ Phosphatic Fertilizer Solutions

☐ Sulfuric Acid

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
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Branches in principal cities

Joins Delta Company

Joe C. Brady (left), general manager of the Delta Fertilizer Co. and the Helena Cotton Oil Co., Helena, Ark., welcomes A. L. McQuary (right) who has joined Delta as manager. Mr. McQuary previously was with the Planters Gin Co., Altheimer, Ark. He succeeds F. L. Enlow, who died last year.

•

North Central ESA To Meet

The North Central Branch of the Entomological Society of America will meet at the Neil House in Columbus, Ohio, on March 25, 26, and 27.

•

Meehan Succeeds Wert at CSC

Joseph R. Meehan has been advanced to senior sales engineer by Minerals & Chemicals Corporation of America, Menlo Park, N. J. He will be in charge of sales and technical service for the company's Attapulgus Clay products used as carriers, diluents and conditioners in the manufacture of pesticides and other agricultural chemicals. In his new position Mr. Meehan succeeds R. W. Wert, who has transferred to the company's chemical distributor service staff.

•

Granular Simazine Available

Geigy Agricultural Chemicals, Division of Geigy Chemical Corp., Ardsley, N. Y., has announced the availability of Simazine herbicide in granular form. The new product is Simazine 4G (4% granular).

•

Boynton Is Sales Manager

L. Ralph Boynton has been named sales manager for the United States Potash Co., Division of the U. S. Borax & Chemical Corp., New York.

MARKET REPORT

Collier Carbon and Chemical Corp. is expanding its Brea, Calif., ammonia plant by 20 per cent. This is in the face of the low prices prevailing on the West Coast for ammonia.

Ammonia prices on the West Coast are down to $66 per ton, some $22 less than those east of the Rocky Mountains. Chances of restoring prices to near previous levels seem remote. The current supply of West Coast nitrogen runs about 672,000 tons per year. New plants and expansions, such as the Brea project, will increase this figure to 826,000 tons. Requirements for 1959, however, will be only 60 per cent of this potential production. It will take at least five years for supply and demand to come into good alignment, assuming that no additional expansions are carried out. Pacific Northwest prices have dropped to $85 per ton and Utah area prices are $80 per ton.

Over-production of ammonia in the East has been estimated at from 20 to 30 per cent for the past year or two. The gap should close, but here, again, it will probably be another five years before supply and demand come into balance. William J. Haude, president of the Grace Chemical Division, W. R. Grace & Co., Memphis, Tenn., said recently, however, that there is no indication that ammonia prices in the East will be reduced to levels approximating those that have been reached in the West.

A reduction of $7 per ton in fertilizer grade urea by a producer in the Midwest has been followed by two other producers, including the Polychemicals Division of E. I. du Pont de Nemours, establishing the product at a record low level of $103 per ton delivered.

The price trend of sulfur is up, according to a Harris, Upham & Co. survey which predicts that the $3 per ton reduction made in 1957 will be restored by the end of this year, because of the "sulfur market's ability to assimilate the new Mex'can tonnage."

•

Glynn Named Chief Engineer

Alfred T. Glynn has been named chief engineer of the Sturtevant Mill Co., Dorchester, Mass., filling the post vacated last October by the death of Edward Ingle. Mr. Glynn had served as interim chief engineer. He joined Sturtevant in 1916.

•

To Use Gibrel on Grapes

Gibrel, the plant growth regulator developed by Merck & Co., Rahway, N. J., will be incorporated into the cultivation practices for large acreages of California grapes this year. This announcement was made by company representatives at a Gibrel Workshop in Fresno, Calif., Feb. 10.

Baker Joins MGK

Griffin J. Baker has joined the research and development department of the McLaughlin Gormley King Co., Minneapolis, Minn. He had been with the Niagara Chemical Division of the Food Machinery and Chemical Corp. during 1958 and prior to that was with the Standard Oil Co.

•

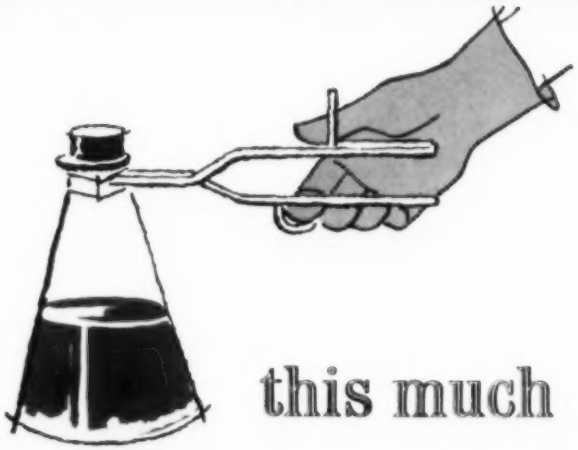
Biochemistry Conf. in Aug.

The program for the third Gordon Research Conference on Biochemistry and Agriculture has been announced by Dr. George L. McNew, managing director of Boyce Thompson Institute and Dr. Robert S. Bandurski, professor of plant biochemistry at Michigan State University, who are serving as co-chairmen of the conference. The conferences, which will cover various chemical aspects of agriculture, will be held at Kimball Union Academy in Meridan, New Hampshire on August 3rd to 7th.

Sessions will be conducted on phosphorus in plant nutrition, directed by Dr. G. L. Bridger of W. R. Grace & Co.; the metabolism of adenyl anhydrides under the chairmanship of Dr. Robert S. Bandurski; the uridine diphosphate sugars and polysaccharide synthesis chaired by Dr. W. Z. Hassid of the University of California; the inhibition of metabolic functions by synthetic chemicals under the chairmanship of Dr. H. P. Burchfield of Boyce Thompson.

At a session on plant growth regulation, under the chairmanship of Dr. A. G. Norman of the University of Michigan, Professor T. A. Bennet-Clark of the University of London will discuss natural mechanisms of growth regulation and Dr. R. L. Wain of Wye College will discuss the metabolism of synthetic regulants in plant tissues.

Those interested in attending the meeting should write Dr. W. George Parks, Department of Chemistry, University of Rhode Island, Kingston, Rhode Island immediately for application blanks since admission is by invitation.



this much Methyl Parathion...

A little Victor methyl parathion puts the *cide* into those pesticides that knock boll weevils and other cotton pickin' pests for a loop.

Cotton farmers and pesticide formulators both bank on the fatal charm of Victor methyl parathion – whether used as a dust, a wettable powder, or an emulsifiable concentrate.

Perhaps you'd like to unload some of your problems . . . make your product more marketable, more economical to produce. You're in the driver's seat, of course, but selecting Victor phosphates, formates, and oxalates can pay dividends—as they have for many others in more than 40 industries. Write on your letterhead for literature of the chemical you are interested in. We'll have data on your desk before you can say, "It *pays* to see Victor."

Victor Chemical Works, Box 572, Chicago 90.

VICTOR

Dependable Name in *Chemicals*

for 61 Years

this much 10-52-17

Dissolve one ounce of Victor Take-Hold* in a gallon of water and you have the perfect transplanting solution for seedlings and setouts.

High-analysis (10-52-17), Take-Hold plant food speeds formation of early root structure . . . helps seedlings overcome "setback shock" at transplanting time . . . resulting in earlier development. Nurserymen and commercial growers like to be in this preferred position of commanding "early bird" prices.

Producers of commercial fertilizers are in a preferred position, too, when they specify Victor P.F.S. (phosphatic fertilizer solution), for Victor—a leading producer of P.F.S.—offers fast and frequent tank car and tank truck delivery from five production points, strategically located from coast to coast.

For a fast start to a solution of *your* problem—either plant food or phosphatic fertilizer solution—contact Victor's technical service department. Or fill in the coupon on the back for your copy of our new bulletin "Handling and Storage of Phosphoric Acid." It's an easy way to learn why *it pays to see Victor*. Victor Chemical Works, Box 572, Chicago 90.

Heads New Merck Region

Frank W. Warren has been named to head the new thirteen-state North Atlantic Region for Merck & Co., Rahway, N. J. Activities of the new region are centered in Teterboro, N.J., to cover Connecticut, Delaware, Maine, Maryland, Massachusetts New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia.

Mr. Warren had been regional agricultural sales manager of the company's former mid-Atlantic division.

•

Cotton Insect Control

Are pink bollworms being whipped? What's new in cotton insect control? These are two of five insect topics discussed at the Western Cotton Production Conference held at the Hotel Westward Ho here, March 3-4. The conference was sponsored by the National Cotton Council and the Southwest Five-State Cotton Growers Association.

The pink bollworm was reviewed by L. F. Curl, assistant director of the Plant Pest Control Division, U. S. Department of Agriculture, Washington, D. C. Dr. G. P. Wene, entomologist at the Cotton Research Center, Tempe, spoke on new developments in cotton insect control.

Three other speakers covering specific areas under the general heading of "a good insect control program and pay-off included" J. N. Roney, Arizona Extension Service entomologist; F. Mike Svoboda, White Chemical Co., Phoenix, and Ted Sick, ranch manager for J. G. Boswell Co., Litchfield Park, Ariz.

•

Seek Aerogel Registration

An application for permanent registration of Dri-Die Insecticide 67 has been made to the U. S. Department of Agriculture by the Davison Chemical Division of W. R. Grace & Co., Baltimore, Md.

In making the application, Davison listed the ingredients at 100 per cent active, including silica gel and ammonium fluosilicate. The silica gel in Dri-Die, in the form of a very light powder known as aerogel, is understood to kill insects by attacking the essential outer waxy layer. Widespread field tests have been conducted.

•

To Handle More Feed

Four new mixer-distributors have been named to handle more liquid livestock feed in the farm areas they serve in Indiana, Michigan, Mississippi and Tennessee by the U. S. Industrial Chemicals Co., New York.

The Kokomo Grain and Feed Co., Kokomo, will supply farmers in Central Indiana. Niemeyer Feed and Fertilizer Company, Crown Point, will distribute in the Northwestern Indiana territory.

In Michigan, Plant Food Service, Inc., St. Johns, becomes the first mixer-distributor in that state. DeSoto Chemical and Supply Co., Nesbit, Tenn., will supply a 5-county area in Northwestern Mississippi and Southwestern Tennessee.

•

Du Pont Names Three

Dr. Joseph A. Evans has been named product manager, insecticides and fungicides for the E. I. du Pont de Nemours & Co., Wilmington, Del. At the same time, the company announced the appointments of Dr. Burton B. Hodgden as sales promotion supervisor on these products, and Dr. Lyall F. Taylor as sales promotion supervisor on herbicides.

Dr. Evans joined du Pont in 1944 after 15 years in county agent and college extension work. Dr. Hodgden had been a sales representative in Memphis, Tenn., and Dr. Taylor was a sales representative in California.

•

To Manage Northwest Sales

Clifford A. Scott has been named region sales manager for the Northwest Region established by the agricultural products division of Merck & Co.'s Chemical Division on March 1. Mr. Scott's headquarters are in Minneapolis, Minn. He joined Merck in 1946.

Fairfield Offers Repellent

Fairfield Chemicals, Food Machinery and Chemical Corp., New York, has announced that Crag Fly Repellent, a Union Carbide Chemicals Co. development will be made available to formulators by Fairfield Chemicals. Fairfield will offer Crag Fly Repellent either alone or in combination with Pyrenone, Fairfield's piperonyl butoxide and pyrethrins concentrate.

Pyrenone insecticide and Crag Fly Repellent combinations are said to perform well in oil base and water base sprays, treadle sprays, pressurized sprays and in back rubbers. The combined formulations, offer rapid knockdown of flies and a high degree of kill plus a long repellent period.

•

New Chipman Herbicide

"Butoxone", a selective weed killer containing 4(2,4-DB), is being offered by the Chipman Chemical Co., Bound Brook, N. J. The herbicide is recommended for control of many broadleaf weeds. For the present, however, its use is limited to application in crops grown for seed.

A liquid, Butoxone is used as a water-mixed spray and may be applied to seedling crops or established stands.

•

Ag-Cat Tours Latin America

Grumman Aircraft's Ag-Cat agricultural biplane was taken on an extensive tour of Latin America last month by the Smith, Kirkpatrick Co., New York, foreign sales agent for Grumman.

The Ag-Cat was flown by the trading company's chief pilot, Lynn Gurley, to Mexico, Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, where its spraying and dusting capabilities were demonstrated to various agricultural groups.

Certified by the Civil Aeronautics Administration with approval having been granted to begin mass production of the plane, the Ag-Cat is being manufactured for Grumman by the Schweizer Aircraft Corp. of Elmira, N. Y.

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Pick the product you want to formulate, and you'll find a PANASOL Solvent you will want to use in your formulation. PANASOL Solvents offer high aromaticity and solvency to help you make quality products *competitively* priced. The low phytotoxicity of PANASOL RX-4 and AN-2K permits you to use them with assurance in crop sprays. Mild odor and light, clear color of PANASOL AN-2 makes it suitable for household spray formulations. PANASOL AN-1 and AN-3 are useful in such specialty formulations as Insecticide-Fertilizer combinations. The ease with which PANASOL Solvents formulate with active ingredients simplifies manufacturing.

The whole PANASOL Solvent story is in the hands of your Amoco Chemicals salesman. He's ready to bring it to you when you call. Or write for Bulletin A2. Your inquiry will receive immediate attention.

Typical Properties

PANASOL Solvent No.	AN-1	AN-2	AN-2K	AN-3	AN-5K	RX-3	RX-4
Distillation 2F., ASTM	D-158	D-158	D-158	D-158	D-158	D-86	D-850
IBP, °F.	400	420	398	450	440	276	282
EP, °F.	494	520	525	534	705	—	—
DP, °F.	—	—	—	—	—	360	320
Specific Gravity, 60/60°F.	0.974	0.986	0.950	0.997	0.943	0.843	0.865
Aromatics, Vol. %	98	99	82	99	71	76	94
Mixed Aniline Point, °F.	55	54	75	54	100	84	59
Flash Point, COC., °F.	190	210	200	225	220	—	—
Flash Point, TCC., °F.	—	—	—	—	—	82	85
Solubility*							
DDT (tech.)	39	42	39	43	28	25	29
BHC (tech.)	29	34	41	31	43	23	28
Lindane	9	10	11	14	5	10	15
Dieldrin	26	28	26	27	25	26	29

*Wt. parts in 100 parts solution at 32° F.

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Discuss Control, Marketing

About 175 fruit growers discussed pest control and marketing and heard reports on recent research at a meeting February 18 in New Haven arranged by Roy E. Norcross, Connecticut County Extension Agent. John Mark Bishop of Cheshire, president of the Connecticut Pomological Society, presided.

James G. Horsfall, director of The Connecticut Agricultural Experiment Station, welcomed the growers. He commended their support of basic research on quality of their products.

Dr. Philip Garman, entomologist of the station, brought the growers up to date on new spray materials. He called particular attention to the necessity of developing new chemicals to control resistant insects. Dr. Patrick Miller discussed the disease, moldy core, and control of nematodes. W. T. Brigham suggested several ways of protecting ripening fruit from damage by birds.

Research on powdered apple juice and other concentrated fruit products at the Eastern Utilization Research Laboratory, U. S. D. A., Philadelphia, was discussed by V. A. Turkott. Reconstituted powdered apple juice made 19 months ago, was sampled by the growers.

•

New Diazinon Formulation

Geigy Agricultural Chemicals announces the introduction of a new Diazinon granular formulation. The new product has been designated as Diazinon 2½G and is being recommended for the control of onion maggots.

Extensive field tests during the past two years have established the effectiveness of Diazinon insecticide formulations for the control of the onion maggot that has become resistant to many of the older insecticides.

A tolerance of 0.75 ppm has been established for onions, which means that Diazinon may be used for the control of onion maggot on green onions, onion sets, dry onions as well as onions grown for seed.

Geigy recommends its new granular formulation as a furrow treatment applied at the time of planting. Onion maggots may also be controlled by the application of Diazinon 25W (wettable powder) or Diazinon 25E (emulsifiable solution) as a soil drench.

This product is also promising for the control of Carrot Rust Fly and a petition is now pending for the establishment of a tolerance for Diazinon insecticides on carrots.

•

Canadian Firm Appoints F&B

The Western Peat Co. Ltd. of Canada has appointed Faesy & Besthoff, Inc., New York, as exclusive sales agents in the Atlantic area for Sunshine Brand peat moss. This marks Sunshine Peat's first attempt at distributing peat moss in the Atlantic area.

•

Dealers Must Keep Current

No commercial fertilizer dealer can serve his farm customers effectively without a full and detailed knowledge of his products and what they can do for various crops and soils, according to Frank E. Adams, western manager of coal chemical sales for the U. S. Steel Co., who spoke at a meeting of fertilizer dealers and distributors from central and southern Utah last month. Dealers and farmers must keep up to date on the latest developments in their fields to stay ahead of rising costs for materials and labor.

Merit Award To Colvin

The National Fertilizer Solutions Association has conferred its Award of Merit on Walter S. Colvin (left), director of agricultural sales for the Nitrogen Division of the Allied Chemical Corp.

The award was presented by E. E. Crouse (right), C. D. Liquid Fertilizer Corp., Liberty, Ind., a former president of the association. Mr. Colvin is the first person to receive the award and was cited for his work in helping to organize the National Nitrogen Solutions Association, forerunner of NFSA.

•

Fertilizer Section Meets

The executive committee of the Fertilizer Section, National Safety Council, met Feb. 13 in Atlanta, Ga. Among the topics discussed at the meeting were the processing of data sheets on the safe handling of pesticides in fertilizer and a possible instruction sheet on the use of scrap metal derived from discarded liquid fertilizer equipment.

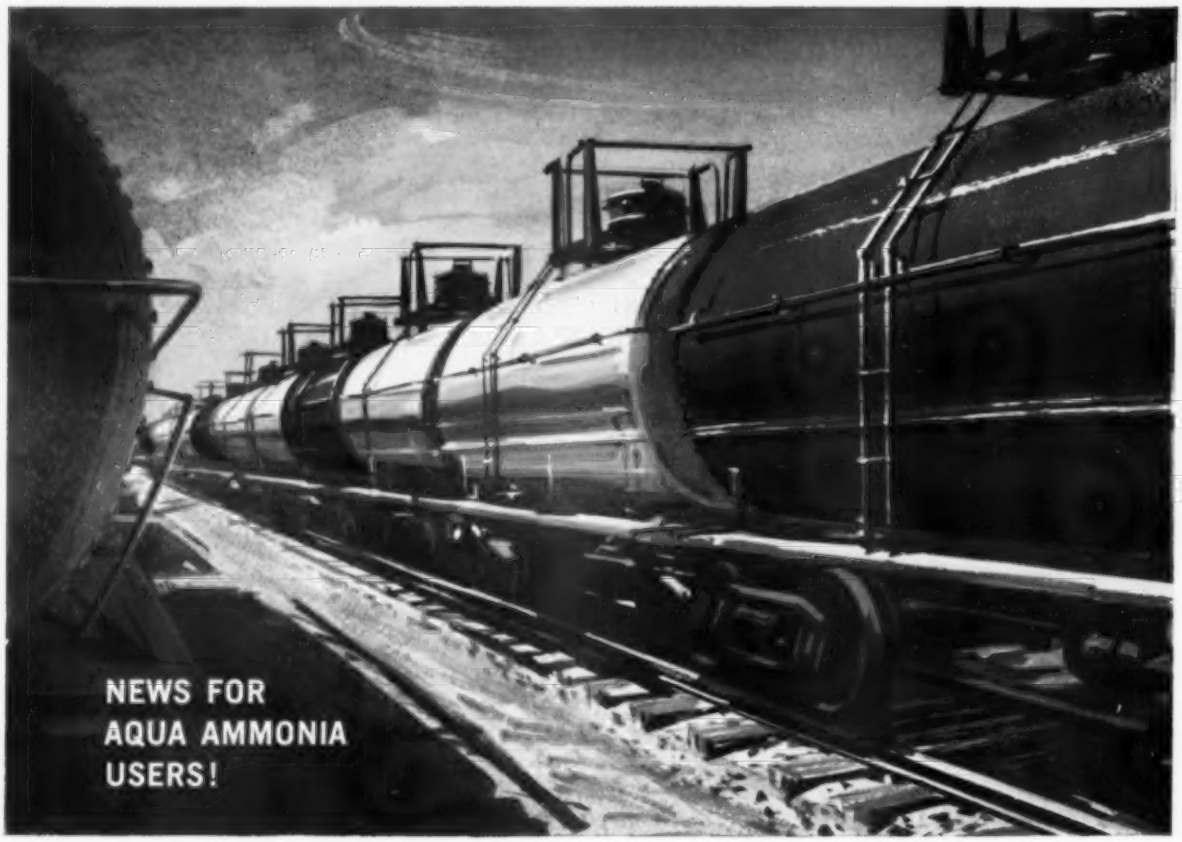
A tentative schedule of five regional fertilizer safety schools, to start in August is planned.

•

Hi-D Fertilizer Poster Campaign

The Commercial Solvents Corp., New York, introduced a poster promoting Hi-D ammonium nitrate fertilizer at its agricultural chemicals department sales convention held in New Orleans in January.

Shown against the poster backdrop are John N. Cronk, advertising manager of CSC and Clyde T. Marshall, general manager of the agricultural chemicals department.



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At your plant, 50% solution is unloaded and diluted to 29.4% without additional investment in handling equipment.

Thus, two tank cars of Texaco 50% NH_3 solution actually give you more ammonia than three cars of the standard 29.4% solution—saving you shipping costs on one car.

Only Texaco offers you this advantage. In addition, Texaco's technical advisory personnel will be glad to discuss with you any questions concerning this unique saving, development of a new product or improvement of an old one. Possibly Texaco research has already solved a problem similar to yours, saving you the expense of duplicate experimentation.

The box at the left shows you some of the high-quality petrochemicals available from Texaco. Whether you need a product or a process, call or write:

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Eastern Garden Supply Trade Show Attracts More Than 6,000

MORE than 6,000 garden supply dealers, distributors, and manufacturers attended the Eastern School of Retail Management and Trade Show at the Statler Hotel in New York, Jan. 30 and Feb. 1 and 2.

An innovation in this year's program was that distributors from New York, New Jersey, and Connecticut markets had buying offices in the exhibition area.

Among the exhibitors was the California Spray Chemical Corp., Richmond, Calif., displaying its new Ortho Rose and Garden Fungicide containing Phaltan. Other new Calspray products were Ortho-Klor 72 Chlordane Spray and Ortho Borer Spray.

The Sprayrite Division of the Virginia Smelting Co., West Norfolk, Va., displayed its new and complete line of aerosols for gardening. Geigy Agricultural Chemicals, Ardsley, N. Y., displayed Simazine 50W and Methoxychlor.

The Chemical Division of the Borden Co., New York, presented its Borden's 38 fertilizer compound and offered samples to visitors. Vaughan's Seed Co., New York, showed herbicides and fungicides, as well as a complete line of lawn seeds and fertilizers. A complete line of garden chemicals offered by the Science Products Co., Chicago, includes insecticides, herbicides, fungicides, miticides, plant foods, and Gibrel and other specialty items.

AmChem Products Inc., Ambler, Pa., displayed its Weedone line of herbicides and its ACP line of garden chemicals.

A Garden Flip Duster that can be operated by a flip of the wrist was demonstrated at the booth of E. I. du Pont de Nemours & Co., Wilmington. The Hayes Spray Gun Co., Pasadena, Calif., exhibited its garden sprayers and presented an informative booklet on spraying to persons stopping at the display.

The American Agricultural Chemical Co., New York, showed its complete line of plant foods, including Agrico, a pesticide and turf food combination.

Chlordane formulations for pest control inside and outside the home were very much in evidence at the show. Seacoast Laboratories, Inc., New York, offered a termite control program featuring Chlordane, and the Velsicol Chemical Corp., Chicago, offered Chlordane for controlling both household insects and crabgrass.

Goulard & Olena, Inc., Skillman, N. J., was on hand with samples of its G&O insecticides, fungicides, and plant foods. The Antrol Garden Line of the Boyle-Midway division of American Home Products Corp., New York, included a variety dusts and sprays and featured new Antrol hose spray concentrates containing Chlordane and disodium methyl arsonate.

Two Projects Designed To Increase British Farm Fertilizer Use

A REPORT in the January 10 issue of *Chemical Age*, a British periodical, points out that the consumption ratio of N, P_2O_5, and K_2O in England is moving towards a 1-1-1 standard. Not many years ago, the ratio was close to 1-2-1.

D. P. Hopkins, author of the report, said that the use of nitrogen and potash has increased during the past three years, while phosphorus use seems to be declining, although it has levelled off after a drop in 1955-56. Farming tradition for regularly using moderate phosphate rates is well established in England, and it is possible that tradition and the advisory influences that recommend lower rates of phosphate for some crops have now reached an equilibrium. A decrease of about 4,000 tons in use of P_2O_5 this past year is much smaller than the drop of over 14,000 tons the year before, the report points out.

A continued and steady increase in potash use is termed surprising, considering that the advance in nitrogen use has been small. It is believed to be a sign that modern farmers are increasingly choosing balanced fertilizer dressings, although there is no subsidy assistance for potash as there is for nitrogen and phosphate in the United Kingdom.

Two recent events may have expansive influences on future fertilizer use. They are the Grassland Utilization Committee's report and the Small Farms Scheme. Although the latter will aid only certain types of small farms, outright grants of up to 1,000 pounds over three to five years for farm expansion schemes approved by advisory services must in many cases bring higher fertilizer use. In addition, farms waiting to be considered can immediately enjoy benefits in a supplementary scheme, one of these being a 75 per cent addition to the present fertilizer subsidies.

The Grassland Committee's report can have only indirect effect, but it should increase the use of fertilizer on grass. A minor recommendation is for the introduction of a subsidy for potash use on grass.

A survey conducted in 1957 indicates that new or increased grassland use does not account for the major part of expanded fertilizer use in the 1950's. There has been practically no increase in rates of nitrogen given to permanent grass, but some increase in rates given to temporary grass.

Surveys of non-use of fertilizer show how much potential opportunity still remains for increased fertilizer consumption. The following conclusions have been drawn from these surveys: At least six out of 10 acres of grassland receive no nitrogen; at least seven out of 10 acres receive no phosphate; at least eight out of 10 acres receive no potash; at least five out of 10 acres of conserved (hay or silage) grassland receive no nitrogen or phosphate; and at least seven out of 10 acres of conserved grassland receive no potash.

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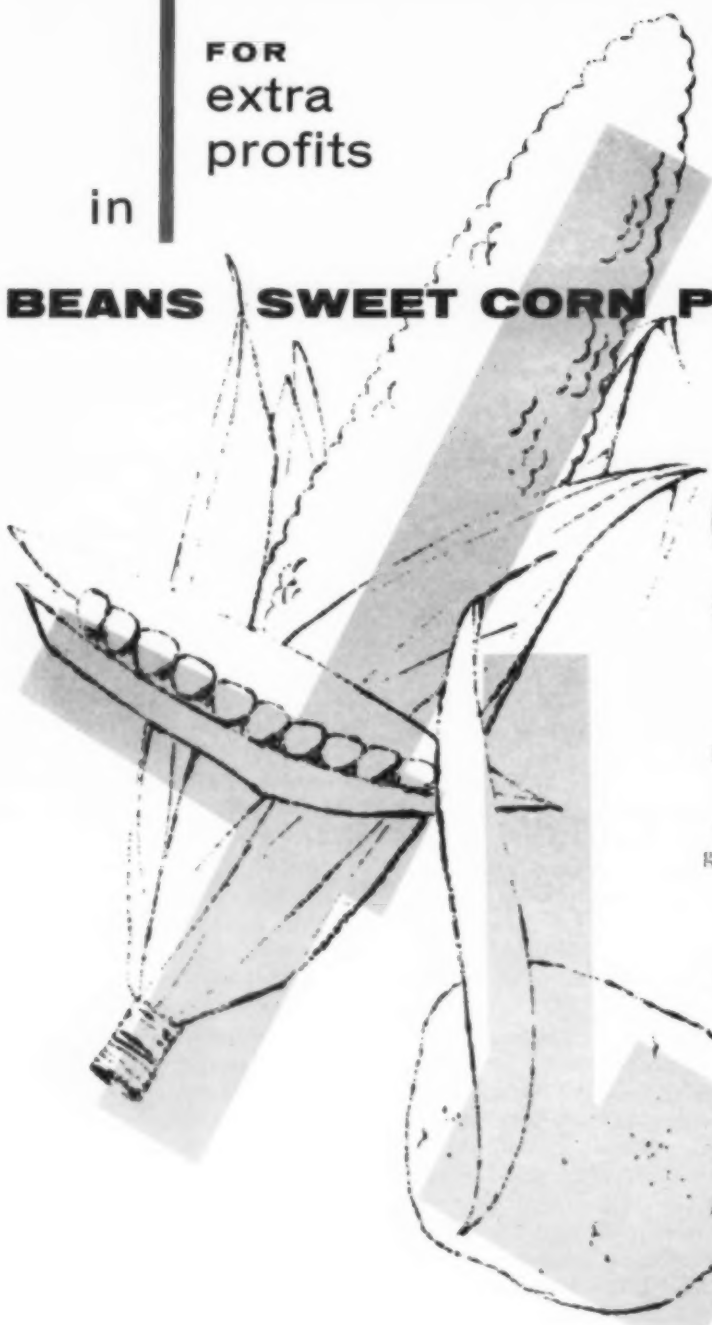

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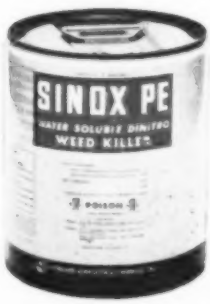

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Hitchner Emphasizes Role of Pesticide Chemicals in Protecting Wildlife Resources—at Meeting of Wildlife Federation. Curl Reviews USDA Policies

CHEMICAL insecticides and their effect on wildlife highlighted discussions at two meetings in New York, the weekend of February 27-March 2.

The first sessions, held during the annual meeting of the National Wildlife Federation, February 27-March 1, at the Sheraton McAlpin Hotel, featured reports on problems resulting from the application of chemical pesticides, with special emphasis on the fire ant program in the south.

The second meeting, held March 2-4, at the North American Wildlife Conference, in the Statler Hotel, included a full program of reports on pesticides and controls. Dr. George Decker, State Natural History Survey, Urbana, Ill., was chairman at this meeting, while F. S. Arant, Alabama Polytechnic Institute, was discussion leader.

H. B. Mills, Illinois Natural History Survey, opened the meeting with a review of "Pest Control in the Modern Setting." R. D. Chisholm, USDA, N. J., reviewed the "Fate of Insecticide Residues in Soil"; while Norman Gannon, Illinois National History Survey, reported on "Hazards of Insecticide Residues.

"Wildlife and the Fire Ant Program," was the subject for Leslie L. Glasgow's paper. Mr. Glasgow is with Louisiana State University. Daniel L. Leedy, U. S. Fish and Wildlife Service, reported on "Pesticide-Wildlife Problems and Research Needs;" Clarence Tarzwell, U. S. Public Health Service, discussed "Pollutional Effects of Organic Insecticides;" and Jerome Besser, U. S. Fish and Wildlife Service, concluded the panel with a report on "Control of Mammal Damage to Crops by Repellents."

Pesticide Panel

At the Federation convention, just preceding the Wildlife Conference, Clarence Cottam, director of the Welder Wildlife Foundation at Sinton, Texas, and chairman of the newly created pesticide committee of the International Association of Game, Fish and Conservation Commissioners, served as moderator for the pesticide panel.

Presenting individual papers on the panel were: Lea Hitchner, executive secretary of the National Agricultural Chemicals Association; Charles Kelly, Alabama Wildlife Federation; Clarence H. Hoffman, assistant director of the Entomology Division, USDA (full text appears of Mr. Hoffman's report appears on page 47); Walter Dykstra, U. S. Fish and Wildlife Service; M. M. Hargraves Mayo Clinic; and L. F. Curl, Plant Pest Control Division, USDA.

Mr. Hitchner reviewed the tests and safeguards employed by the pesticide industry through which they try to make spray programs as safe as possible. He emphasized that "pesticides are among the most thoroughly tested chemicals on the market today."

Mr. Hitchner reminded that pesticides make a very important contribution toward protection of wildlife resources. "Briefly we have a choice," he observed. "The use of pesticides with some possible temporary damage to wildlife under certain conditions, or less foods at higher prices; healthy forests and beautiful shade trees, or their destruction; healthy livestock, or sickly, scrubby animals; a healthy population, or the existence, actual and potential, of malaria, yellow fever, sleeping sickness and other insect-borne diseases."

Outlining the role of pesticide chemicals in protecting and building our wildlife resources, Mr. Hitchner referred to recent development of chemical weapons for the control of the sea lamprey in the Great Lakes which he cited as an example of pesticide's usefulness in wildlife management. In this same category he listed the use of herbicides to improve game habits, contributing to better food availability for wild birds; scientific forestry techniques through the use of pesticides to preserve and improve our supply of valuable timber; the use of herbicides to improve deer browse; the artificial creation by the use of herbicides of open areas to make possible an increase in small forms of animal life; and the use of pesticides to clear ponds of undesirable fish, allowing more rapid growth of desired species. He placed particular emphasis on the grasshopper program that annually saves millions of dollars worth of crops in 17 western states and the role of pesticides in keeping under control the Dutch Elm disease, the gypsy moth, the imported fire ant and the medfly.

Referring to charges that the use of pesticides endangers public health, Mr. Hitchner noted that the U.S. Public Health Service has conducted large scale population checks in several areas of the country following broadscale pest control programs and "has been unable to find any harmful results that can even remotely be traced to pesticide applications." He also replied to the criticism that use of pesticides upsets the balance of nature. "Has nature ever been in balance?" he asked. "Even in the wildlife field do we not have to control certain forms of wildlife in order that more desirable forms may develop?" A recent case in point was the action by the Fish and Wildlife Service in authorizing the killing of common mergansers in the state of Washington where they were found to be causing serious depredations upon the trout population.

In conclusion, he answered criticism which has been levied by some critics of the spray program at the insecticide industry—which they have accused of "lobbying"

(Continued on Page 102)

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Make no mistake, we do not underrate the importance of quality. We know that the Davison Hi-Flo Triple Supers (Run-O-Pile, Gran-U-Lated and Blend-Phos); Davison Normal Supers; Phosphate Rock and Phosphoric Acid are unexcelled by any on the market.

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NPFI News

Soil sampling encourages higher fertilizer rates in south; East and west programs emphasize yield increases through adequate fertilization.

IN THE EAST . . .

Addressed N. C. Society

At a recent meeting of the North Carolina Soil Science Society, Dr. E. J. Kemprath, director of the soil testing division of the North Carolina Department of Agriculture, discussed the response of corn to applications of fertilizer phosphorus and potassium on soils of different fertility levels.

On Coastal Plains soils, he said, the average response to additions of fertilizer phosphorus was 16 bushels per acre when the soil tested medium or less of this element. When the soil tested high, the response to applied phosphorus amounted to four bushels per acre.

A significant point emphasized by Dr. Kemprath was that corn yields on soils that were high in phosphorus, and to which no fertilizer phosphorus had been added immediately before planting, were higher than the yields on those soils that were medium or lower in phosphorus but to which fertilizer was added immediately prior to planting. This, he said, illustrates the importance of maintaining a high level of soil fertility through the adequate and intelligent use of lime and fertilizer.

IN THE SOUTH . . .

Tennessee Fertility Program

Participants in the University of Tennessee's soil fertility demonstration program met in Nashville, Jan. 29 and 30, to plan final details. Dr. W. D. Bishop, extension agronomist, is conducting the program.

The five counties that will participate are Gibson, Greene, Lawrence, Monroe, and Overton. Twenty-six members of the extension service attended the meeting, including district agents, crop specialists, county agents, and associate and assistant agents.

Dr. Bishop advised the group that the programs should be planned by individual counties and executed so that the maximum effort would be exerted this fall on an intensive soil testing and fertility program. The National Plant Food Institute is preparing slides for each county to use in their publicity programs.

Fertilizer Consumption Up

Fertilizer consumption in 1958 jumped by 16,213 tons for a 10.1 per cent increase in a six-county intensified soil fertility area of South Central Georgia, according to a report presented recently at the annual meeting of the Georgia Plant Food Educational Society in Athens.

Plant nutrient consumption increased by 17.5 per cent in 1958 over 1957. This increase occurred within the six-county intensified fertility area, although state-wide figures of total fertilizer consumption showed a drop of more than one per cent from 1957 to 1958.

These and other figures were included in a report presented by Dr. R. L. Wehunt, extension agronomist, at the meeting. The intensified soil fertility program was initiated in the fall of 1957 by the Georgia Agricultural Extension Service. Dr. Wehunt attributed the success of this program to good organization, the team approach, and enthusiasm on the part of all participants. He said that soil samples taken in this area increased from 2,000 in 1957 to 10,014 in 1958.

Dr. Wehunt added that soil testing can play a major role in persuading farmers to use the correct amount of the right kind of fertilizer, and he credited much of the success of the soil fertility program to the soil testing phase.

During the fall of 1958, the Georgia soil fertility program was expanded to include 26 additional counties. The National Plant Food Institute is continuing to provide active support of this program in Georgia through grants-in-aid and by supplying visual aids for use in the 26-county area.

IN THE WEST . . .

Fertilizer and Irrigation

Fertilizer and water work together as a team, and offer promise of tremendous increases in crop protection, according to Dr. Richard B. Bahme, Western Regional Director of the National Plant Food Institute, San Francisco. Dr. Bahme was addressing the California Irrigation Conference held on the University of California campus recently.

He cited seed cotton in Kern County, Calif., in 1957 as an example to show the impressive results of fertilization with proper irrigation. With very limited irrigation and no fertilizer, 2,300 pounds of seed cotton per acre were produced; when 100 pounds of nitrogen per acre were applied, production increased to 2,411 pounds per acre, he said. But with frequent irrigation and 100 pounds of nitrogen, Dr. Bahme added, 2,788 pounds of cotton per acre were realized.

The N.P.F.I. currently is supporting research at the U. of California to bring to light new facts on the interaction of fertility and soil moisture.

Recognize Colorado Farmers

Eleven outstanding Colorado farmers were recognized at the National Farm and Ranch Congress banquet in Denver on March 2 according to Dr. Richard B. Bahme, Western Regional Director of the National Plant Food Institute. Of the eleven men, seven were honored for exceeding 200 bushels of

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MEETING CALENDAR

Mar. 2-3 — Southern Safety Conference, Fertilizer Section, Asheville, N. C.

Mar. 4-5 — Georgia Entomological Society, 23rd Meeting, Radium Springs Hotel, Albany, Ga.

Mar. 4-5 — Nebraska Weed and Pest Control Meeting, Fonner Park, Grand Island, Nebr.

Mar. 17 — Spring Meeting of Western Agricultural Chemicals Association, Hotel Miramar, Santa Barbara, Calif.

Mar. 25-27 — North Central Branch, Entomological Society of America, 14th Annual Meeting, Neil House Hotel, Columbus, Ohio.

June 9-10 — Seventeenth Annual Convention of the Association of Southern Feed and Fertilizer Control Officials, Velda Rose Motel, Hot Springs, Arkansas.

June 14-17 — National Plant Food Institute, Annual Convention, Greenbrier Hotel, White Sulphur Springs, W. Va.

June 22-25—Agricultural Institute of Canada, Annual Meeting with cooperating societies, Winnipeg, Man.

June 29-30 — California Fertilizer Conference, University of California, Davis.

July 7-9 — Pacific Northwest Plant Food Assn., 10th annual Regional Fertilizer Conference, at Tacoma, Wash.

July 29—Kentucky Fertilizer Conference, Guignil Theater, University of Kentucky campus, Lexington.

Aug. 3-7 — Gordon Research Conf. on Biochemistry and Agriculture, Kimball Union Academy, Meridan, N. H.

Oct. — Third week of—Symposium on the Insect Resistance Problem, Sponsored by NACA and ESA, Washington, D. C.

Oct. 21-23—National Agricultural Chemicals Association, 26th Annual Meeting, French Lick-Sheraton Hotel, French Lick, Indiana.

Nov. 4-6—Fertilizer Industry Round Table, Mayflower Hotel, Washington, D. C.

Nov. 9-11 — California Fertilizer Assn., 36th Annual Convention, Fairmont Hotel, San Francisco.

Nov. 16-20 — National Aviation Trades Assn., 20th Annual Convention, New Orleans, La.

corn to the acre, the other four achieved membership in the 10,000 Pound Sugar Beet Club for impressive sugar beet production records.

Production achievement awards were presented to each grower at the banquet by the National Plant Food Institute. Dr. Bahme has been cooperating with Rodney Tucker of Colorado State University Extension Service in setting up this recognition program.

Among the guests at the Production Achievement Award Banquet were representatives of the fertilizer industry, hybrid corn companies, sugar beet processors, county agents, bankers' agricultural representatives, farm press, farmers and university personnel.

IN THE MIDWEST . . .

Agronomists and Industry Representatives at Joint Meeting

"DEALER training programs are one of the major problems facing the fertilizer industry," observed F. E. Hartzler, business consultant of Kansas State Teachers College, when speaking at the 11th annual joint meeting of Midwestern Agronomists and Fertilizer Industry Representatives at the Edgewater Beach Hotel, Chicago, February 12-13. Research and extension agronomists from 13 midwestern states, as well as representatives of companies in the fertilizer industry attended the meeting.

"The fertilizer industry, like any other, must depend on dealers to move their merchandise," said Mr. Hartzler, "This is of primary importance. It is not important that your dealers are small business. Three times as much merchandise is moved by firms with less than three employees, as is moved by firms with more than 50 employees." He suggested that the fertilizer industry be ready to make a study to determine the practices followed by its best dealers, and with the information set up standards for measuring business results, then prepare a standard operating procedure manual and a specific training program.

Estimating Crop Response

George R. Blake, University of Minnesota, reported that modern research can help soil scientists predict the probable number of rainless days in a crop growing season in a given area, and thus estimate the crop response to fertilizer. The key to this development, he said, is increased knowledge of water storage in the soil, the movement of water, and its use by crops.

Recent research advances, he continued, "have placed at our disposal important tools for incorporating simultaneously fertilizer and moisture factors into expected yield results. We now can estimate quite accurately from weather records the actual amount of moisture leaving the earth by evaporation and transportation. By combining this with actual rainfall records and with runoff estimates, we can specify the level of soil moisture at a given time." Mr. Blake said that current researches are "just as important to agriculture as moon rocketry is to national security."

Fertilization Investigations

C. J. Overdahl, University of Minnesota, reported that corn yields go up when the plant population is increased on high-fertility soils that receive plant food treatments. He based his statement on a study of results in the Minnesota X-Tra Yield, X-Tra Profit Corn Contest. Mr. Overdahl said that corn yields average 117 bushels per acre over a six-year period when the population exceeded 18,000 plants per acre on fields that were fertilized. At a 14,000 to 16,000 plant population level, yields on fertilized fields averaged 102.1 bushels, compared with 89.1 on unfertilized plots. Farmers participating in the contest, showed returns ranging from $10.31 to $16.37 per acre over the cost of the fertilizer.

Heavy fertilization over the past four years has boosted corn yields nearly 100 bushels per acre on experimental fields at Urbana, Illinois, according to the report by M. B. Russell, head of the University of Illinois agronomy department. The fields had been cropped continuously to corn for 83 years,—and had received no plant food until 1955. Mr. Russell also reported that Illinois research indicates that soil management practices which boost crop yields, also increase the efficiency of water use.

Hay yields were boosted 5¼ tons per acre over a three-year period when legume-grass pastures received a heavy application of phosphate-potash fertilizer at seeding time, and an annual top-dressing each spring, stated E. C. Doll, University of Kentucky agronomist. The hay yields were 9.3 tons per acre for the three years on a fertilized field, compared with 3.6 tons on an unfertilized check plot. "The success or failure of a seeding may be dependent on the fertilizer treatment,—particularly in areas where freezing and thawing results in considerable heaving."

Harold F. Rhodes, University of Nebraska agronomist, stated that winter wheat yields can be increased profitably by top-dressing the crop with nitrogen fertilizer. Nebraska tests have indicated that spring or fall applications of ammonium nitrate for winter wheat have given similar average increases. A higher protein content for the grain has been obtained generally from spring application.

"Fertilizer use on Nebraska farms totaled 232,000 tons last year," he reported. "This was an increase of 66,000 tons over the 1957 total. The 1958 fertilizer included 93,200 tons of nitrogen, 17,800 tons of phosphate and 1,300 tons of potash."

Honor Agronomy Students

Paul E. Kaste, University of Minnesota agricultural student, was named winner of the 1958-59 National Plant Food Institute Agronomy Achievement Award for the school.

THE FLUID ENERGY

JET-O-MIZER

The modern mill for processing heat sensitive organic toxicants

Pesticides and fungicides in concentrates and field strength wettable powders and dusts, using BHC, Chlorodane, DDT, Dieldrin, Endrine, Heptachlor, Toxaphene and similar organic toxicants, can now be prepared with ease, using the Fluid Energy "Jet-o-mizer."

This heatless, motionless mill processes these low melting point, heat sensitive materials with a minimum of mill build-up. There are no moving parts to generate heat, no screens to plug.

Formulation is simplified too. Inerts do not compact . . . there is no lowering of oil absorption value. Consequently, less high priced carrier is needed . . . more lower cost extender can be used.

And there are other values to Fluid Energy processing of these important agricultural chemicals:

- The "Jet-o-mizer" grinds "coarse" . . . for specifications calling for 325 mesh products. Or they grind fine . . . as low as ¼ micron average, or to satisfy WHO and ICA requirements.
- The "Jet-o-mizer" is versatile . . . it handles a wide range of raw materials and products well . . . it is ideally adapted to off-season grinding of inerts and other materials.
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- The "Jet-o-mizer" efficiency at the fine grind end of the spectrum improves residual toxicity of most pesticides.
- The "Jet-o-mizer" combines many operations . . . wet clays can be dried, ground, blended with toxicants and classified . . . all in one operation.
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A typical Fluid Energy Mill installation, in continuous operation for more than ten years.

Cooperatives Handle $275 Million In Fertilizer Business

FARMERS did 6.4 percent more business on a dollar basis through their cooperatives in 1956-57 than in the previous year, according to Farmer Cooperative Service, U. S. Department of Agriculture.

At the same time the total number of cooperatives remained substantially the same and memberships dropped from 7,730,710 to 7,671,730.

The survey showed 9,872 marketing, purchasing, and related service cooperatives in 1956-57 as compared with 9,876 the previous year. Many cooperatives discontinued operating during this year because of liquidation, consolidation or merger, but at the same time many new associations were formed.

Number of memberships may have passed their peak, inasmuch as there was a decline for the first time in 1956-57. With the decrease in number of farms, this decrease in number of memberships is perhaps to be expected.

These cooperatives did a net business of $10.4 billion compared with $9.7 billion the year before. It included $8 billion for farm products marketed, more than $2.1 billion for farm supplies, and $235 million for services performed for patrons. Percentagewise this represented an increase of almost 7 per cent for farm products, which is higher than the increase of about 2 per cent in cash receipts to farmers for that period. Farm supplies increased 5 per cent and service receipts 9 per cent.

Increases in the net value of dairy products, grain, poultry, rice, sugar products, and tobacco were largely responsible for the increase in cooperative volume. At the same time, however, livestock and wool showed decreases. All farm supplies showed increases, and for feed, fertilizer, and petroleum products these were substantial.

Farm supply cooperatives represented 34 per cent of the total number. These farm supply associations also accounted for nearly 46 per cent of the total memberships.

The survey showed 63 per cent of all marketing cooperatives handled at least some production supplies and 59 per cent furnished specialized or general services for their patrons, while 22 per cent of the farm supply cooperatives marketed farm products and 42 per cent performed various services for their patrons.

About 93 per cent of all cooperatives included in this survey were local associations, and these accounted for more than three-fifths of the total memberships. The others were regional cooperatives.

Dairy products continued to lead in value of farm products with a net value of almost $2.8 billion as compared with $2.5 billion the previous year. They accounted for nearly 35 per cent of the total net value of farm products marketed by these farmer businesses.

In farm supplies, feed again ranked first with a net business of $804 million, petroleum products second with $530 million, and fertilizer was third with nearly $275 million.

First three states by estimated number of cooperatives, memberships, and business were:

Number of cooperatives—Minnesota (1283), Wisconsin (779), and Iowa (690).

Number of memberships—Minnesota (569,110), Illinois (552,180), and Missouri (450,240).

Business—California ($1,066,525), Minnesota ($177,304), and Illinois ($638,346).

The survey showed that 4,143 cooperatives handle fertilizer, for a gross annual business of $433,873. Net business after adjusting for duplication is estimated at $274,615.

The USDA bulletin on this survey may be obtained by writing to the USDA, Washington, D. C., for Bulletin USDA 257-59-4.

300 To Attend Soil Conf.

Some 300 people are expected to attend the seventh annual California Fertilizer Conference, June 29 and 30 on the campus of the University of California at Davis. J. H. Nelson and Earl R. Mog are co-chairmen of the conference.

NOXIOUS PESTS

(From Page 48)

less to plants and animals, and are apparently unaffected by insecticides, they warrant far more study. Some important findings have already been made as indicated by the following examples, but as yet they are rarely used to provide economic control of pests.

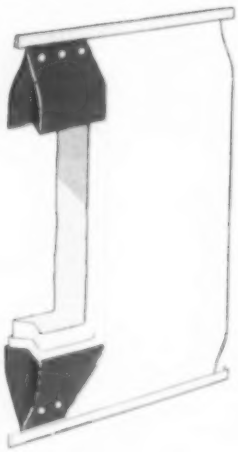
Japanese beetle grubs live in the ground, where they may be attacked by several bacteria, principally *Bacillus popilliae*. When the larvae ingest the spores, they develop milky disease and die. The spores persist in the soil and revitalization occurs by infection of invading grubs. Methods have been found whereby these spores could be produced in living grubs and processed with talc to produce a dust. The spore dust has been widely distributed and is of considerable value in holding down Japanese beetle populations. With the further spread of the beetle and the need for nonchemical control methods, there has been a renewed interest in this disease. Research by the Department is under way seeking to produce a bacterium economically on an artificial medium in order that it may be available for more widespread use in lieu of chemicals.

(To be concluded in April)

Need a little added bag muscle? Bemis Strength-End Multiwalls give it ...*ECONOMICALLY*

Could your multiwalls use a little more muscle on jobs for which they may now be a trifle light? Are you getting breakage . . . and complaints?

There's no need to add a whole ply to your multiwalls and boost your cost appreciably. You can save money . . . and get the strength you need . . . by using job-tested Bemis Strength-End Multiwalls, with added strength top and bottom, where most sewn-bag breakage occurs.



Or maybe your problem is that you're somewhat OVERpackaged. You could eliminate a full ply and, in its place, use Strength-End protection. And save *that* way.

Bemis Strength-End Multiwalls have been successfully used in all sections of the country and under all climatic conditions.

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New Pesticides

Conclusion of a two-part listing of some 85 pesticides—their application, manufacturer and chemical name.

Herbisan 5 – Roberts Chemicals, Inc., Nitro, W.Va. A herbicide suggested primarily for use against weeds in onion crops. Active ingredient is bis ethyl xanthogen.

HCA—General Chemical Co., New York. Hexachloroacetone (HCA Weed Killer) has been marketed commercially for a little more than a year. Present registration applies to use only on non-crop areas such as railroads, pipelines and other right-of-ways.

Inverton 245—Dow Chemical Co., Midland, Mich. Invert emulsion formulation designed to cut the spray drift hazard to a minimum. Containing 2,4,5-trichlorophenoxy acetic acid, the new product promises effective weed and brush control on transmission and distribution right of ways.

Korlan 25W—Dow Chemical Co., Midland, Mich. New fly control pesticide offered commercially in 1958. The product has USDA label approval for fly control use in dairy barns, other farm buildings and refuse cans. Chemically, O,O-dimethyl O-2,4,5-trichlorophenyl phosphorothioate.

Karmex—E.I. du Pont de Nemours Co., Wilmington, Del. New tradename for herbicides based on diuron.

Kloben—E.I. du Pont de Nemours Co., Wilmington, Del. New tradename for neburon herbicides.

Karathane—Rohm & Haas Co., Philadelphia. A new fungicide that has protective properties plus some eradicating properties when applied as a foliar spray. Chemically, dinitro (1-methyl heptyl) phenyl crotonate.

Kelthane—Rohm & Haas Co., Philadelphia. A miticide, used commercially in 1958, reported to be toxic to motile forms of mites, and ovicidal to some species. Chemically, 1,1-bis (chlorophenyl)-2,2,2-trichloroethanol).

Kemate—See Dyrene.

Mylone Soil Fumigant—Union Carbide Chemicals Co., New York. Suggested for use as an active ingredient in soil fumigant formulations for preplanting control of certain weeds, nematodes and soil fungi. Active ingredient is 3,5-dimethyl tetrahydro-1,3,5,2H-thiadiazine-2-thione.

Navadel—See Delnav.

Nemagon—Shell Chemical Corp., New York. Soil fumigant which is said to be non-phytotoxic to crops.

Mitox—California Spray Chemical Corp., Richmond, Calif. Low toxic, long residual ovicide and larvicide, developed initially by Boots Pharmaceutical Co., England. Chemically, p-chlorophenyl-p-chlorobenzyl sulfide.

OS 2046—See Phosdrin.

Ozoban—California Spray Chemical Corp., Richmond, Calif. A new plant spray reported to reduce crop losses from smog.

Phosphamidon — California Spray Chemical Corp., Richmond, Calif. A systemic insecticide for control of aphids, mites, certain beetles and other pests, which will be available in limited quantities in 1959. Chemically, 2-chloro-2-diethylcarbomoyl-1-methylvinyl dimethyl phosphate.

Phostex — Niagara Chemical Division, FMC, Middleport, N.Y. Miticide said to be very effective in control of the blister mite complex on pears. Chemically, bis (dialkoxyphosphinothioyl) disulfide in which the alkyl groups are ethyl and 2-propyl.

Phaltan—California Spray Chemical Corp., Richmond, Calif. A new fungicide which appears to be effective on a number of fungi on fruit, vegetables and ornamentals. Available commercially in 1959. Chemically, N-trichloromethyl thiophthalimide.

Phosdrin—Shell Chemical Corp., New York. An organic phosphate insecticide, known formerly as OS 2046, designed for control of wide range of crop pests. A systemic which is short lived on plant tissues, and may be applied within one to four days of harvest.

PRD Experimental Nematocide—Developed through cooperative research by Boyce Thompson Institute and Diamond Alkali Co. for use in agriculture and on ornamentals. Chemically, 3,4-dichloro tetrahydrothiophene 1,1-diozide.

Rogor — Montecatini, Milan, Italy. Pesticide for olive fly control. Chemically, N-ethyl-o, o, dimethyl dichloro phosphoryo acetamide.

Sevin—Union Carbide Chemicals Co., New York. Contact insecticide which was approved in 1958 for use on pears, beans, grapes and apples. It is also approved for use on cotton. Chemically, 1-naphthyl N-methylcarbamate.

Simazine—Geigy Agricultural Chemicals Co., Ardsley, N.Y. Herbicide for industrial and general weed control. Product is promising for pre-emergence weed control in corn and ornamentals. Currently approved for use in industrial weed control.

Sesone—Union Carbide Chemicals Co., New York. Herbicide suggested for use on strawberry plantings among other crops. Known during experimental stage as 2,4-DS.

Sesoxane—Shulton, Inc., Clifton, N.J. Synergist for pyrethrins, allethrin and methoxychlor.

Sodium a,b-dichloroisobutyrate—Rohm & Haas Co., Philadelphia. An experimental growth regulator, which has the unique property, at proper concentrations, of killing only pollen.

Sytam—Pennsalt Chemicals Corp., Tacoma, Wash. Trade name for a product containing four pounds of technical schradan. Schradan is the generic name for octamethyl pyrophosphoramide, also known as OMPA. Schradan is a systemic phosphate type insecticide and an acaricide.

S-847—Spencer Chemical Co., Kansas City, Mo. A post-emergence herbicide which shows promise in control of wild oats. Chemically, 1-chloro-2-butynyl N-(3-chlorophenyl) carbamate.

SD 4402—Shell Chemical Corp., New York. Experimental chlorinated hydrocarbon insecticide highly effective on lepidopterous larvae, coleoptera and diptera. Field tested for the first time in U.S. during 1958. Available for experimental trials only during 1959. Chemically, 1,3,4,5,6,7,8,8-octachloro - 3a,4,7,7a - tetrahydro-4,7,methanonaphthalan.

Tabatrex—Glenn Chemical Co., Chicago. Repellent particularly useful against horse flies. Product can be formulated with livestock insecticides.

Telvar—E. I. du Pont de Nemours & Co., Wilmington, Del. New tradename for compounds based on monuron (herbicide).

Thuricide—Bioferm Corp., Wasco, Calif. Trade name for what may be a series of microbial insecticides. Thuricide is based on *Bacillus thuringiensis*.

Tedion—Niagara Chemical Division FMC, Middleport, N.Y. A miticide especially effective in control of tetranychid species of mites. Chemically, 2,4,5,4 tetrachlorodiphenyl sulphone.

Thimet—American Cyanamid Co., New York. Systemic insecticide for control of cotton, alfalfa and sugar beet insects. Chemically, O,O-diethyl S-(ethylthiomethyl) phosphorodithioate.

Thiodan—Niagara Chemical Division, FMC, Middleport, N.Y. Broad spectrum insecticide, particularly effective as an aphicide. Chemically, hexachloro-hexahydromethano - 2,4,3 - benzodioxathiepin oxide.

Trithion—Stauffer Chemical Co., New York. An insecticide-miticide which is non-systemic, long-residual, effective on a wide range of insects. Chemically, O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate.

Trolene—Dow Chemical Co., Midland, Mich. A systemic insecticide applied orally for cattle grub control. Chemically, O,O-dimethyl 0,2,4,5-trichlorophenyl phosphorioate.

Terraclor—Olin Mathieson Chemical Corp., Baltimore, Md. A soil fungicide for control of soil-borne diseases of cotton, crucifers, peanuts, and other crops. Active ingredient is pentachloronitrobenzene.

Tryben 200—E.I. duPont de Nemours & Co., Wilmington, Del. Herbicide based on the dimethylamine salt of trichlorobenzoic acid plus dimethylamine salts of other polychlorobenzoic acids, and containing two pounds of trichlorobenzoic acid equivalent per gallon. Product made available commercially in 1958.

Thioneb—Naugatuck Chemical Division, U.S. Rubber Co., Naugatuck, Conn. Foliar fungicide which shows promise for use on fruits and vegetables, but not yet cleared for commercial use. Chemically, polyethylene thiuram sulfide.

038188—Rohm & Haas Co. An experimental fungicide that has protective properties but is especially an eradicant of established infections. Chemically, a nickel chloride-carbamate combination.

2,3,6-trichlorobenzoic acid—Heyden Newport Chemical Corp., New York. A new group of herbicides based on 2,3,6-trichlorobenzoic acid, said to show outstanding promise for control of bindweed and other deep-rooted perennial weeds.

2,4-DS—See Sesone.

NAC Lists Views

The National Agricultural Chemicals Association, Washington, D. C., has issued a statement summarizing its views on a number of issues facing the pesticide industry. The statement is carried in the January issue of the association's *News and Pesticide Review*.

Among the positions announced by the NAC are that it will request an amendment to the Miller law that will eliminate fees charged for the establishment of a tolerance, and that it opposes all legislation that could put the government in the business of producing or distributing pesticides.

The NAC also holds that pesticides should be exempted from pharmacy and poison bills because they already are regulated under federal and state pesticide acts. In addition, the NAC feels that bills which would require all users of pesticides to obtain licenses from the state are not necessary.

Further, the NAC believes that agricultural chemicals are entitled to the same tax exemptions as other essential farm supplies used to produce a crop. NAC supports the policy of prohibiting sales of pesticides in broken packages and is opposed to regulations providing that the date of manufacture of a pesticide be printed on a container or label.

NAC feels that states should not evolve their own pesticide rules until a pattern has been established at the federal level.

Other issues on which the NAC position was clarified were, pesticides and wildlife, safety, and publicity.

Arcadian® News

Volume 4 | For Manufacturers of Mixed Fertilizers | Number 3

HOW TO TAKE THE PANIC OUT OF PRODUCTION!

SUGGESTIONS TO HELP YOU:

- *Get tonnage out on time*
- *Hold the analysis*
- *Maintain top condition*

Making mixed fertilizer efficiently takes: a) thorough preparation, b) carefully supervised production. Invariably, the most successful producers are those who operate in accordance with these two basic principles—whether they make pulverized or granulated fertilizer.

Getting the Tonnage Out

One of the main reasons for inability to maintain tonnage schedules is "taking too long" to start up and shut down production. Producers should strive to come as close as possible to simultaneous operation of all controls that directly affect the processing of the product.

Another obstacle to getting tonnage out is *fluctuating* recycle. In fact, many tons per day can be added to the production pile by taking corrective measures at the first sign of fluctuation. For if fluctuations are allowed to continue, they usually lead to *uncontrolled* recycle, and the radical adjustments that can destroy the quality and quantity of production. If uncontrolled recycle develops it is wisest to dump some material rather than spend the day fighting the problem. However, be sure there is no change on analysis if much of any segment of the production is taken from the flow.

It is amazing how some producers will continue to lose tonnage simply because of inadequate equipment. For example, some operations have flowrators and other meters or measuring tanks that are too small to accommodate the quantities of nitrogen solution commonly used today. Such meters may have to be replaced with larger types, but in many cases they can be increased in capacity rather easily. It pays to see if the meter

manufacturer provides such a service before replacing with a larger meter.

It goes without saying, that with so many variables that can cause problems, the *least* the producer should have is up-to-date equipment in top condition, and a thorough knowledge of basic techniques. He will have enough to do just keeping up with preventive maintenance. One of his most important jobs is checking the air handling system. Any leaks here can seriously reduce the effectiveness of both dryers and coolers. Drying, compromised by faulty air systems, often causes poor granulation as well as poor drying, for some systems accomplish a big part of the granulation in the dryer.

Holding the Analysis

The practical limits for combining chemicals are valid only if equipment and techniques were originally sound, and have been protected against corrosion and abrasion. Equally important, they must have been protected against the added deterioration of operations that drift to the "easy way." For the "easy way" usually turns out to be the *wrong* way.

In terms of equipment: Failure to keep the upper and lower connections of gauge glasses on measuring tanks thoroughly cleaned by wire brushing and flushing with water has caused more faulty proportioning of nitrogen solutions than all other causes combined. "Creep" in the gauge glass immediately after the inlet or outlet valve is closed usually indicates that some gauge glass connection is choked. Connections that are above the liquid level can become fouled as well as those that are in contact with the nitrogen solutions. "Creep" can also come from leaking valves, in which case the "creep" continues until pressures are equalized. The "creep" caused by restricted gauge glass connections continues for varying lengths of time, according to the extent of the restriction and the rate of filling the measuring tank. In any case, there is always a lag in the levels between the tank and glass—both in filling and discharging.

Before a gauge glass becomes fully choked, the over-charging and discharging goes as high as 100 pounds per batch. However, the amount of over-charging for the first few batches after restriction of flow begins is too small to be important. Whatever it is it cannot be determined from the analysis of the pile of finished goods. For the inaccuracies started at practically zero and increased to as much as 2 units of nitrogen—with the increase becoming more rapid as flow failed completely. A representative sample could hardly be taken from the pile when the constantly increasing error may have been distributed over the contents of several tank cars.

In terms of technique: Distribution of dry materials and all liquids—*including acids*—in the mixer should be as uniform as possible—for this has direct bearing on the amount of nitrogen retained in the product. This holds for both pulverized and granulated fertilizer.

Water should not be used for flushing the flowrator in sulphuric acid service, for this can cause so much corrosion of the stainless steel float that great inaccuracies will occur.

It is well to remember that low analysis of goods and "shortages" of nitrogen solution, as well as pollution of the air, can be caused by excessive venting of storage and measuring tanks, and too-rapid or non-uniform introduction of the ammoniating media into the mixture. The ammonia gas that leaves the nitrogen solution in such a case is actually 82% nitrogen—forever lost to the fertilizer.

Some plants penalize their production unnecessarily by operating the equipment at less than capacity. Needless to say, it's more efficient to correct whatever condition is forcing this conservatism, so that production can attain full rated capacity at all levels.

Maintaining Top Condition

A sure way *not* to get good condition is to operate mixers and screens that are partially or nearly completely fouled by accumulated deposits. Fouling can be caused by poor distribution of liquids and dry ingredients in the mixer.

Rehandling pulverized fertilizer for drying and cooling after ammoniation at high rate aids condition. Producers should use the solution that needs high rates of ammoniation, especially if there is to be much cooling of the product. When aiming for minimum moisture in pulverized goods, it's best to use ingredients with low moisture content.

DO'S and DONT'S for Better Selling

DO plan ahead! Set a sales quota (a little higher than you think you can reach). Budget *enough* for pump priming: advertising, promotions, etc.

DON'T slight old accounts to develop new ones! Better to fatten up on the bird in hand than starve for the two in the bush.

DO take a personal interest in the customer's problems! It's *his* order—big or small—that interests him most.

DON'T talk price first! Talk profits! The customer is more interested in "get" than "give".

DO create desire for your product! Convince him he needs it—and you couldn't stop him from buying. Demonstrate product quality . . . underscore superiority—if any—over competition.

DON'T ever ignore a customer's complaint! It's better to hear harsh words than not to hear from him at all.

DO keep sales charts! Pinpoint sales trends—total and by accounts—so you can pin down the reasons why.

DON'T lose contact with your customers! Out of sight, out of mind . . . out of orders!

DO show genuine enthusiasm! Sell *yourself* on the product *first*—so customers will know what side *you're* on.

Arcadian News for Fertilizer Manufacturers . . . . . from NITROGEN DIVISION

"I picked 140 bushels of corn per acre following a single plow-down application of 14-7-7 fertilizer" is the profit-building story Julian Luebker tells fertilizer dealer Louis Frank. "In my opinion," says this Henry County, Ohio, farmer, "2-1-1 fertilizer ratios are tailor-made for continuous corn." Corn land like his is only one of many good markets for high-nitrogen 2-1-1 fertilizers.

Profits for Everybody in 2-1-1 Fertilizers!

Everybody wins with high-analysis 2-1-1 fertilizers. This fact is becoming evident to farmers and their agricultural advisors, as well as to fertilizer manufacturers and dealers everywhere. It is the reason why a number of manufacturers have already made the minor plant conversions necessary to make 14-7-7, 16-8-8 and 20-10-10 fertilizers.

To farmers, the success of high-nitrogen mixed fertilizers on major crops is proved in high yields, year after year, with a single, low-cost application each season of a 2-1-1 ratio fertilizer. This success is based on the fact that corn, grass, small grains, cotton and other major crops all consume twice as much nitrogen as phosphoric acid, and considerably more nitrogen than potash.

One of the most pressing needs of every farmer is to save all the labor he can, so as to keep costs down, so that his high yields will return more profit per acre. One application per season of a fertilizer that fulfills all the plant food needs of a crop is a sure work-saver, yield-builder and money-maker! Successful farmers are quick to see the value of these high-nitrogen mixed fertilizers. Now you can make them – and make money doing it.

Practical and Profitable

The technique for making these high-nitrogen grades at low cost is ready and waiting for you. Nitrogen Solutions developed by Allied Chemical research enable you to make 2-1-1 ratio fertilizers with modifications of your present equipment and processes. Because all the nitrogen for these fertilizers comes from Nitrogen Solutions, your cost per ton is low. At the same time, you can sell this extra nitrogen tonnage to greater advantage in mixed fertilizers than as straight nitrogen top-dressing. And by putting all the plant foods in one package, you don't risk the loss of part of the nitrogen sale in the form of nitrogen top-dressers. Once over the field does the whole job for the farmer. And one sale by your dealer sells all the plant food each acre needs and gets.

Hundreds of field demonstrations by farmers, dealers and county agents have shown the practical benefits of these high-nitrogen fertilizer grades. You will profit by encouraging your dealers to set up such field tests with the 2-1-1 fertilizers you manufacture. It will pay you to get all the facts on the benefits of making and selling 2-1-1 ratios. Write or call Nitrogen Division, Allied Chemical, 40 Rector Street, New York 6, N. Y.

New Research in Pine Forest Fertilization

How to make fertilizer application pay on pine forests is the aim of a new research study sponsored by Nitrogen Division at the North Carolina State College Department of Forest Management.

First aim of the work with loblolly pine, an important timber tree, is to determine the conditions under which it pays to use fertilizer. This involves finding the minimum amounts of nutrients a tree can have in its foliage without limiting growth, along with fertilizer applications in analyses based on soil and foliage tests.

The work is being done with pines growing on Piedmont and Coastal Plain soils, on forest sites of good, medium and poor quality.

CORRECTION

The sulfuric acid table on page 1 of the *Arcadian News, Volume 4, Number 1*, had one incorrect figure in it. This table should have read as follows:

SULFURIC ACID

Grade	Per Cent Acid	Per Cent Water	Pounds Reacting With 1 lb. Ammonia
60° BE	77.67	22.33	3.71
66° BE	93.19	6.81	3.09
	100.00	0	2.88*

*(For comparison—not used.)

If you keep file copies of the *Arcadian News*, we suggest that you make this correction. We trust that this typographical error caused you no inconvenience. Such things occasionally happen despite all precautions.

HERE'S THE BIG LINE OF Arcadian® NITROGEN SOLUTIONS

When you purchase your nitrogen requirements from Nitrogen Division, Allied Chemical, you have many different nitrogen solutions from which to select those best suited to your ammoniation methods and equipment. You are served by America's leading producer of the most complete line of nitrogen products on the market. You get formulation assistance and technical help on manufacturing problems from the Nitrogen Division technical service staff. You benefit from millions of tons of nitrogen experience and the enterprising research that originated and developed nitrogen solutions.

	CHEMICAL COMPOSITION %						PHYSICAL PROPERTIES		
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60°F	Approx. Vap. Press. at 104°F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®									
2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
URANA®									
6C	43.0	20.0	68.0	6.0	6.0	9.3	1.180	12	39
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	- 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
15	44.0	28.0	40.0	15.0	17.0	12.7	1.052	29	1
U-A-S®									
A	45.4	36.8	—	32.5	30.7	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	13.5	0.978	48	46
Anhydrous Ammonia	82.2	99.9	—	—	—	24.3	0.618	211	-108

Other ARCADIAN® Products: URAN® and FERAN® Solutions • Ammonia Liquor • N-dure® A-N-L® • Ammonium Nitrate • UREA 45 • Nitrate of Soda • Sulphate of Ammonia

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Columbia 1, S. C., 1203 Gervais St. ..... Alpine 3-6676
Atlanta 3, Ga., 127 Peachtree St., N. E. Jackson 2-7805
Memphis 9, Tenn., 1929-B South 3rd St. Whitehall 8-2692
Columbia, Mo., 1134 Highway 40W ..... Gibson 2-4040

Indianapolis 20, Ind., 6060 College Ave. Clifford 5-5443
Kalamazoo, Mich., P. O. Box 869 ..... Kalamazoo 5-8676
St. Paul 14, Minn., 764 Vandalia St. ..... Midway 5-9141
San Francisco 4, Cal., 235 Montgomery St. Yukon 2-6840

Wyoming Sulfuric Acid Plant

The first sulfuric acid manufacturing plant in Wyoming to produce acid for sale to fertilizer manufacturers and other industries has started operations at Riverton, Wyo. The plant is owned by Fremont Minerals, Inc., and has a rated capacity of 100 tons per day.

Sulfur for the plant is obtained from local Wyoming suppliers who recover it from sour natural gas.

•

Cyanamid Grant To MSU

A grant-in-aid to study systemic insecticides and their effect on cattle grubs has been accepted by Mississippi State University from the American Cyanamid Co., New York.

Dr. W. W. Neel of the university's department of zoology and entomology will conduct investigations of several anti-grub compounds.

•

T. A. Quinn Co. Builds

The T. A. Quinn Chemical and Fertilizer Co., Yazoo City, Miss., is building a $40,000 plant to manufacture low analysis liquid mix solution fertilizer. The plant is expected to be in full operation this month.

•

Niven Joins AP&CC

William M. Niven has joined the American Potash & Chemical Corp., Los Angeles, as export manager.

Mr. Niven, who will headquarter at the company's New York offices, previously was export manager and assistant treasurer of Internatio-Rotterdam, Inc., in New York.

•

Corn Borers Decrease

A marked decrease in the average abundance of European corn borers found last fall throughout the United States was noted in figures released Jan. 30 by the U. S. Department of Agriculture. Fifty-eight additional counties were reported infested for the first time, however.

Based on comparable districts surveyed, the average number of borers per 100 plants decreased from 162 in 1957 to 94 in 1958. In 1956 the count was 112.

•

Named By Stauffer

C. Graham Randall has been appointed technical service representative for the Northwest states by the Stauffer Chemical Co.'s Agricultural Chemical Division. He had been with Stauffer's agricultural research laboratories at Mountain View, Calif.

Also in the Northwest, Stauffer has named K. Lee Sturgess to the position of assistant regional sales manager. He has been a sales representative in Oregon and Washington for the past several years.

•

Huber Offices Move

The Industrial Products Department of the J. M. Huber Corp., now is located at 630 Third Avenue, New York. Huber has taken the entire twelfth floor of a new building at that site.

Alfred Gunderson Retires

Alfred J. Gunderson, a well-known figure in the pesticide industry who's career reaches back to 1911 when he was an associate at the Illinois Agricultural Experiment Station, has announced his retirement from the Sherwin-Williams Co.

•

To Offer Garden Products

Agricultural Products Co., a division of Nutrilite Products, Inc., Buena Park, Calif., plans to introduce a new line of garden products during 1959.

•

Simplot Plant Expansion

An expansion of its fertilizer plant has been announced by the J. R. Simplot Co., Pocatello, Idaho.

It will include a new plant for the manufacture of sulphuric acid and an addition to the main plant to increase production by an estimated 65 percent to about 175,000 tons of high analysis fertilizer annually.

23rd Purdue Pest Control Conference Attracts 400

The 23rd annual Purdue pest control operators conference was held in the Purdue University Union and Memorial Center, Lafayette, Indiana, January 26-30, with some 400 registrations.

The meeting provided a variety of important subjects which were discussed by authorities from every part of the country. Half day sessions were held to discuss home protection service, vertebrate pests, cockroaches, the pest of the year, ornamental and lawn insects, termites, insecticides and a session on miscellaneous problems, including mosquito abatement districts, fly control and a report on a new grain fumigant, Phostoxin.

The annual dinner, Thursday evening, was featured by Al P. Stewart and his Purdue All-American Glee Club, and included comments and presentations by O. D. Roberts, Dean of Men, J. V. Osmus, J. J. Davis, R. E. Heal, Dean V. C. Freeman and was concluded with a talk, "Education-Our Inexhaustible Resource" by Dr. E. L. Butz, Dean and Director of Agricultural Activities. Col. Ed. Gabbard, Assistant Business Manager acted as toastmaster.

C. Norman Dold of Chicago and Harlem Ives of Detroit, attended their 23rd meeting and eight men received 10 year certificates. They were Michael Ballantine, Chicago; William A. Eichler, Chicago; Ralph E. Heal, Elizabeth, N. J.; Clyde Parker, Champaign, Ill.; Ed H. Purcell, Fort Wayne, Indiana; R. M. Russell, Atlanta, Georgia; H. E. Ryder, Hamilton, Canada; and Lea Sain, St. Louis, Missouri. Of the over 1400 individuals who have attended the Purdue Conference, 80 have attended ten or more years.

Thirty-five states and Canada were represented at this year's Conference and over 70 persons attended for the first time.

The 1960 Purdue P.C.O. Conference is scheduled for February 1-5, 1960 and the "Pest of the Year" has been designated "Lice, Mites, Ticks, and Fleas."

You kill all this Russian Knapweed with sodium chlorate today . . .

And a year from now the area will still look like this.

How to kill most any weed the same way

All you need is Oldbury® sodium chlorate to clear any area completely of weeds.

It costs about 25¢ per hundred square feet of area. No expensive equipment is required.

Hooker agronomists will help you set up weed control plots and show you how to store and handle sodium chlorate.

You get fast delivery on the sodium chlorate from the Hooker plants in Niagara Falls, N. Y. and Columbus, Miss. It's 99% pure.

Write for descriptive bulletin. For those interested in defoliating cotton or clearing railroad rights-of-way, we will be glad to refer you to formulators or specialists in these applications.

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BREVITIES

JOHN HERBERT KELLY, JR., general superintendent of the Etiwan Fertilizer Co., Charleston, S. C., died last month.

AC

JAMES F. MCCARTHY has been named manager of the Cleveland district office for Commercial Solvents Corporation. Mr. McCarthy joined CSC in 1953 as an industrial chemicals salesman and has served in Chicago and Indianapolis.

AC

BERKSHIRE CHEMICALS, INC., New York, has been named exclusive sales agent for the products of the Heavy Minerals Co., Chattanooga, Tenn., including rare earths and thorium compounds.

AC

WILLIAM P. BRASHEAR has joined the sales organization of the United States Potash Co., division of United States Borax & Chemical Corp., New York. Mr. Brashear, who lives in Sulphur Springs, Texas, will work in the company's southwestern territory.

AC

HUBBARD S. CAVEN and A. Nelson Myers were elected vice presidents of Texas Gulf Sulphur Company. Mr. Caven has headquarters in Houston, Tex. Mr. Myers is manager of sales and operates from the New York office.

AC

MERLE V. HALVERSON, for the past two years a University of Minnesota soils research worker, has been appointed as a soils specialist for the Minnesota Agricultural Extension Service.

AC

THE HOOKER CHEMICAL CORP., Niagara Falls, N. Y., has formed an autonomous Eastern Chemical Division and has made autonomous an earlier-formed Phosphorus Division. Thomas F. Willers and F. Leonard Bryant have been appointed general managers of the divisions.

AC

THE CITY COUNCIL of Metropolis, Ill., last month voted to prohibit the construction of a fertilizer plant in that city. The action came after a petition bearing 145 names of residents had been presented to the council.

AC

THE WASATCH CHEMICAL CO., Salt Lake City, Utah, has been named by the Onyx Oil & Chemical Co., Jersey City, N. J., to distribute Onyx' chemical products in the Idaho, Montana, Utah and Colorado areas.

AC

WAKELON FERTILIZER CO., Zebulon, N. C., has been organized with capital stock of $6,000.

AC

OHIO VALLEY FERTILIZER, INC., Maysville, Ohio, has been incorporated to manufacture and deal in fertilizer and farm products.

AC

DON GRAVLEE has joined the agricultural sales department of the Pacific Coast Borax Company Division of the United States Borax & Chemical Corp., Los Angeles.

AC

GUANOS Y FERTILIZANTES, has started construction of a sulphuric acid extraction plant at Coatzoacoalcos, Veracruz, Mexico.

AC

THE DIXIE FERTILIZER CO., Jackson, Miss., has been incorported in Mississippi, preparatory to its formal organization.

AC

AN INTERNATIONAL ORTHOCIDE CONFERENCE held in Vienna, Austria, Dec. 8 to 13, brought together delegates from companies specializing in protection of crops against plant disease in 23 countries. Norbert B. Van Buren, president of the California Spray-Chemical Compagnie Francaise, conducted the sessions.

AC

THOMAS A. BAKER JR. has joined the agricultural chemicals division of the Stauffer Chemical Co., New York, as a sales and technical representative. Mr. Baker is headquartered at North Little Rock, Arkansas.

AC

INDIA PHOSPHATE FERTILIZERS Ltd. has been granted a charter of incorporation in New York to deal in fertilizers and chemicals.

AC

FARMERS FERTILIZER SERVICE, Inc., has been incorporated in Nampa, Idaho.

AC

THE DIXIE FERTILIZER CO., Meridian, Miss., plans to construct a plant which would manufacture fertilizer, using activated sludge from Meridian's sewerage treatment plant as the primary base material.

AC

WILLIAM E. PLUMMER has been appointed works manager of the fertilizer plant of Canadian Industries Ltd. at Chatham, Ontario. He joined C-I-L in 1957.

AC

THE COOPERATIVE FARM CHEMICALS ASSN. plans to install facilities for the production of urea nitrate at its Lawrence, Kansas, nitrogen fertilizer plant.

AC

D. J. MURRAY, formerly sales manager for the Borden Chemical Co., New York, has been named general sales manager of Nursery Specialty Products, Inc., Croton Falls, N. Y.

AC

BURLEY-BELT PLANT FOOD WORKS has been incorporated in Lexington, Ky., to manufacture and deal in fertilizer and farm products.

Equipment, Supplies, Bulletins

API Silviculture Handbook

The American Potash Institute, Washington, D. C., has issued a handbook on forest fertilization that includes articles by C. O. Tamm, member of Sweden's Forest Research Institute; T. Ewald Maki, head of Forest Management in the N. C. State College School of Forestry; S. P. Gessel and R. B. Walker, University of Washington forest soils scientists; Dr. W. Wittich of the Soil Science Institute in Hann Munden, Germany; Donald P. White, professor of forestry at Michigan State; Earl L. Stone, professor of forest soils at Cornell; and E. T. York, of the American Potash Institute.

The handbook is free through the American Potash Institute News Service, 1102 16th Street, N. W., Washington 6, D. C.

•

Cole Tanks Booklet

The R. D. Cole Manufacturing Co., Newnan, Ga., has prepared a booklet on tanks and equipment for the plant food industry. Described in the booklet are aluminum tanks for solution storage, measuring tanks, field tanks, large diameter tanks, and Cole rotary dryers, coolers, and granulators.

•

Finco Way-Matic Bagger

Finco, Inc., Aurora, Ill., has announced that its Way-Matic Bagger now is available for general distribution.

The machine is intended for use with seed, feed, grain, chemicals, clay products, fertilizer, and other industries using dry free-flowing materials. It handles cloth, paper, or multiwall bags from five to 100 pounds, or more.

•

All-Purpose Goodyear Pump

Goodyear Pumps Ltd., Camborne, Cornwall, England, has formed an American outlet, Goodyear Pumps Inc., New York, for its new Goodyear Pump, a positive displacement, rubber-to-metal type pump.

According to the company, the Goodyear pump has the rubber bonded to metal inserts for strength and resilience and its operation is confined to two moving parts in contact with the liquid, the metal rotor and the rubber bonded plate wheel.

•

Safety Relief Valve

The Bastian-Blessing Co., Chicago, is offering a three port safety relief valve manifold for NH_3 service that provides protection against tank shutdowns necessitated by the periodic removal of relief valves for replacement or testing.

The new RegO manifold makes it possible to remove any one of the three safety relief valves while the tank is under pressure.

•

Carbide Emulsions Booklet

The Union Carbide Chemicals Co., a division of Union Carbide Corp., New York, has issued an extensive sales booklet on emulsions and detergents that contains 100 pages of technical information.

Included in the booklet are specific formulas employing Carbide's products for use in agricultural chemicals formulations, among other products.

•

Light Weight Drum Heater

A new model light weight, complete drum heater for melting of drums or barrels of tars, asphalts, heavy oils, greases, paints, varnishes, pitches, resins, plastics, shortening, gelatinous materials, and various other fluids is being offered by the Glas-Col Apparatus Co., Terre Haute, Ind. The heater is designed in two parts — a roll-away base and a cylindrical cover — and completely encloses a drum. Complete information is incuded in Bulletin DH-100 available from the company at 711 Hulman St., Terre Haute.

Diamond Herbicides Charts

The Diamond Alkali Co., Cleveland, Ohio, has prepared a series of folders describing a variety of Diamond's weed and brush killers. Included in the series are folders on Diamond's Fence Rider, Crop Rider, and Line Rider herbicides. The folders open into wall charts that list recommendations for various weeds and crops.

•

Bemis Flexible Bagger

A flexible bag packer that can be adjusted to handle free-flowing or semi-free flowing products has been developed by the Bemis Bro. Bag Co., St. Louis, Mo., in a single- or duplex-scale model.

The bagger, the Bemis-Way Scale, can fill and weigh 25- to 200-lb. size multiwall paper, polyethylene or textile bags at speeds up to 18 bags per minute, and maintain weight accuracy within two ounces. A gravity bulk or vibrator bulk feed system for increasing flow of product is optional.

•

Evans Research Booklet

The Evans Research and Development Corp., New York, has published a booklet describing its varied activities in the chemical, physical and bio-chemical fields and including a list of some of the organizations and agencies that consult Evans Research.

•

F&P Flowmeter Specifications

A specifications sheet has been issued by the Fischer & Porter Co., Hatboro, Pa., to describe its Ori-Flowrater Meter, a kinetic manometer type flowmeter that measures by-pass flow as a function of main line flow across a set of orifice taps.

The folder is available from the company at 33 Jacksonville Road, Hatboro.

HEPTACHLOR SOIL INSECT SELLING THEME for 1959!

SOIL INSECTS EAT UP PROFITS!

KILL SOIL INSECTS with HEPTACHLOR!

HERE'S THE 1959 HEPTACHLOR SOIL INSECT PROGRAM . . . a series of regional campaigns designed to help HEPTACHLOR formulators, distributors and dealers from coast to coast!

WESTERN STATES
INSECTS: wireworms, root maggots, strawberry root weevils, flea beetles, clover root weevils
CROPS: vegetables, corn, potatoes, berries, other crops
TIMING: March & April

CORN BELT STATES
INSECTS: corn rootworms, wireworms, cutworms, white grubs, seed corn maggots, Japanese beetle larvae, root weevils
CROPS: corn, potatoes, vegetables, other crops
TIMING: March, April, May

KENTUCKY
INSECTS: wireworms, mole crickets, seed corn maggots, tobacco webworms, green June beetles, cutworms
CROP: tobacco
TIMING: April & May

EASTERN STATES
INSECTS: wireworms, white grubs, European Chafers, rootworms, Colorado potato beetles, flea beetles
CROP: potatoes
TIMING: January through April

SOUTH CENTRAL STATES
INSECTS: Rough headed corn stalk beetle
CROP: corn
TIMING: March & April

GEORGIA-ALABAMA
INSECTS: wireworms, southern corn rootworms, white fringed beetle larvae, Colorado potato beetles
CROP: potatoes
TIMING: January and February

INSECTS: white grubs
CROP: peanuts
TIMING: March and April

THE CAROLINAS
INSECTS: thrips, southern corn rootworms
CROP: peanuts
TIMING: April, May

INSECTS: wireworms, cutworms, flea beetle larvae
CROP: tobacco
TIMING: March

INSECTS: wireworms, southern corn rootworms, white grubs
CROP: corn
TIMING: February

FLORIDA
INSECTS: wireworms, cutworms, white grubs, white fringed beetles, mole crickets, rootworms, flea beetles, ants
CROPS: sweet corn, tomatoes, potatoes, melons, vegetables, other crops
TIMING: September through December

TO BE SURE YOU GET COMPLETE INFORMATION IN ADVANCE OF THESE PROGRAMS, FILL OUT AND MAIL COUPON. SPECIFY PROGRAMS OF SPECIAL INTEREST.

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Please see that I am on your mailing list. AC-39
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THE MAN WITH THE MULTIWALL PLAN

UNION PACKAGING SPECIALIST BOB BUCK

lowers customer's bag costs $35,000 annually

A little weight reduction can go a long way in trimming Multiwall costs. Union Packaging Specialist Bob Buck demonstrated just how far during a study of one company's bagging operation.

The company had been using a baler bag of 160# total basis weight. Union's analysis proved that a 70/70 bag would be equally effective. The 20# reduction resulted in a savings of $35,000 a year.

This economy came through Union's 5-Star Packaging Efficiency Plan. Among the other improvements were: (1) A new, revised specifications manual which simplifies and streamlines inventory control. (2) Standardization of all bag printing. This assures delivery of completely uniform print copy from the firm's various suppliers.

Union's plan is producing thousands of dollars worth of savings for Multiwall users, large and small. It might point the way to a greater return on your packaging investment. Write for details.

Union Multiwall Recommendations are based on this 5-Star Packaging Efficiency Plan

- DESIGN
- EQUIPMENT
- CONSTRUCTION
- SPECIFICATION CONTROL
- PLANT SURVEY

Better Multiwall performance through better planning

union camp

UNION'S PACKAGE ENGINEERING DEPARTMENT will study your Multiwall bagging methods and equipment and make appropriate recommendations, regardless of the brand of Multiwalls you are now using.

UNION MULTIWALL BAGS

UNION BAG-CAMP PAPER CORPORATION

233 BROADWAY, NEW YORK 7, N. Y.

Highway Equipment Folder

A booklet that describes the use of bulk fertilizer is being offered by the Highway Equipment Co., Cedar Rapids, Iowa. The booklet contains information on restoring plant foods, soil testing, liming, proper application of fertilizer, and effective spreading patterns.

The publication, "Your Land Is Different," is available from the company at 696 D. Avenue N.W., Cedar Rapids.

•

New Swathmaster Brochure

The Transland Aircraft division of the Hi-Shear Rivet Tool Co., Torrance, Calif., has issued a revised brochure on the Sellers Swathmaster.

Included are new applicating photos with description of crop, chemical, and flow rates; new functional diagrams of flow-regulating mechanisms; and revised ordering instructions.

•

Peerless Pump Line

The Peerless Type A Pump is described in a bulletin issued by the Peerless Pump Division, Food Machinery and Chemical Corp., Los Angeles.

According to the manufacturer Peerless Type A pumps can be applied to a wide variety of pumping jobs handling water and other liquids even when there is a modest amount of non-abrasive solids in suspension.

•

Dust Collector Book

A 24-page illustrated application handbook describing the use of "Dustube Collectors" for efficient dust and fume control, is being offered by the Wheelabrator Corp., Mishawaka, Indiana. The book describes a wide range of industrial dust and fume producing processes that can successfully be controlled with the properly designed cloth or glass bag-type dust collectors.

•

Haynes Alloys Booklet

The Haynes Stellite Co., Kokomo, Ind., a division of the Union Carbide Corp., has prepared a 40-page guide to the corrosion-resistance of Haynes alloys. Included in the booklet are charts and graphs that show penetration rates for the alloys in over 250 corrosives.

•

Ammonia Gauge Catalog

Anhydrous ammonia gauges are described in a catalog prepared by Rochester Gauges Inc. of Texas, Dallas, that includes illustrations and specifications on a wide variety of liquid level gauges and flow indicators.

Automatic Bag Ejector

Manual lifting of filled bags is said to be eliminated by an automatic bag ejector which is described as part of a mill feed packing system in a four-page, two-color bulletin being offered by the Richardson Scale Co., Clifton, N. J.

The ejector automatically transfers filled bags from a bag table onto a bag sewing conveyor belt, and may be applied to existing Richardson MSM Packers as well as new machines.

✓ TYPE 41 CLAY

In making organic concentrates using benzene hexachloride, chlordane, toxaphene, and other similar materials, it is important to have the concentrates free flowing.

TYPE 41 Clay can be combined with more costly diluents, such as Fuller's earth, and the result will be a free-flowing concentrate, at a lower cost to the producer.

TYPE 41 Clay has the following advantages:

- NON ABRASIVENESS
- FINE PARTICLE SIZE
- ADSORPTIVENESS
- PROPER BULK
- HIGH INSECTICIDAL VALUE OF CLAY ITSELF
- LOW PH VALUES
- NO PHYTOTOXICITY TO PLANTS
- OUTSTANDING ABILITY TO STICK TO THE LEAF

For Further Information or Samples Write to

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CLAY COMPANY

AIKEN, SOUTH CAROLINA

WILDLIFE MEETING

(From Page 85)

for these pest control programs. "This we categorically deny," said Mr. Hitchner. "The programs are determined by competent scientists at the Federal and State levels after careful studies of the problems involved. We realize that there are extremists on both sides of the subject," he added, "but nothing is gained by the continuation of a fear campaign. It is our hope that the wildlife problems can be solved and their relation to other segments of our economy can be worked out on a scientific basis. It is to be hoped that the interested groups can together develop a sound approach to the problem, realizing that in some instances some segments of our economy, including wildlife, will be temporarily affected."

L. F. Curl, Assistant Director, Plant Pest Control Division, ARS, USDA, Washington, D.C., outlined "policies and methods in the use of chemical pesticides by the Division of Plant Pest Control and its cooperators." Authority for the programs which have been conducted by the USDA lies in the U.S. Department of Agriculture Organic Act of 1944 as amended in May 1957. This basic legislation, he indicated, is very clear in authorizing the participation of the Department in plant pest programs.

Such area-wide pest control programs are of tremendous importance to the country, he observed. "Prompt discovery and eradication of a new pest may save farmers and others untold millions of dollars . . . We assure you that true conservation of our country's resources is the objective of every plant pest program under the direction of the Plant Pest Control Division of the ARS."

The USDA, he observed, has the responsibility of conducting plant pest control programs in such a way "as to serve the greatest possible number of people." Much of the dissatisfaction that has been expressed with such programs as the Medfly eradication program in Florida, the gypsy moth program in the Northeast, and the imported fire ant program in 9 Southern states comes from "highly organized and voluble minority groups," he added.

Many of the fish and wildlife conservationists have failed over the past year or so to cooperate genuinely with the State-Federal plant pest control programs, Mr. Curl commented. As an example he cited the case of an experiment in Wilcos County, Alabama, involving some 3,600 acres which were sprayed as a part of the fire art eradication program. The Alabama Department of Agriculture, the Experiment Station system of Alabama, the Alabama Conservation Department and the Plant Pest Control Division were all involved in the program. At the insistence of the Conservation Department, he noted, the entire area was treated by plane, approximately one-half with 20 pounds of 10 per cent heptachlor granular, and the other half with the same dosage of dieldrin. Normally, he indicated, the area known as Beaver Swamp would not have been treated. The regular ARS procedure would have resulted in the swamp being flagged and no insecticide applied. Wildlife kill resulted and Mr. Curl noted that this was "promptly reported by the conservation people." Yet, he added, "I have never seen any news item explain that the experiment was not typical of the regular fire ant eradication methods."

Replying to criticism that the fire ant control program was started without adequate research work being done in advance, he asserted that "A great deal of very fine and worthwhile research work had been done on the imported fire ant before the eradication effort got underway." From this research and from experience with previous soil-infesting pests, a number of valuable facts were disclosed which are being utilized in the imported fire ant control program. These findings were:

(1) Granular insecticides should be applied when there are no puddles of water.

(2) Care must be exercised to prevent application of heptachlor or dieldrin to surface of ponds or streams.

(3) Drainage areas should be treated on a progressive basis to prevent contamination of ponds and streams from run-off water.

(4) Large blocks of infestation should be treated progressively to protect the wildlife of the area as a whole. Our experience of the past 18 months proves that progressive treatments permit rapid recovery of all wildlife populations.

C. H. Hoffman of the Entomology Research Division, Agricultural Research Service, USDA, talked on "Biological control of noxious insects and weeds." He observed that biological control agents are important checks on many destructive pests, but when they do not give the degree of control required, resort must be had to other methods. Thus, today greatest reliance is placed on insecticides. Where biotic agents cannot be substituted for insecticides, it is often still possible for them to be used as supplements, thus making it possible to reduce the overall amount of chemical toxicants employed. (The full address appears on page 47.) ★★

•

Add Chlordane Spray

The Science Products Co., Chicago, has added a 72 per cent Chlordane spray to its line of garden chemicals. The company was an early formulator of Chlordane products—its 45 per cent Chlordane-45 was marketed in 1949—and once more is making the Chlordane lawn spray available in a complete range of sizes, from four-ounce bottles to drums.

Surface Moisture Gauges

Two new probes, developed by Nuclear Chicago Corp., Chicago, are said to permit rapid determination of moisture content and density on the surface level of material, eliminating the necessity of removing, weighing, or destroying a sample for testing.

The surface probes are suited for tillage and cultivation studies to determine the effects of compaction and moisture variation on plant growth, according to the manufacturer. Full information, including illustrations and detailed specifications, is available from the company at 229 West Erie Street, Chicago 10.

•

Kennedy Crushers Bulletin

A new bulletin issued by the Kennedy Van Saun Manufacturing and Engineering Corp., New York, describes ten gearless gyrator reduction crushers varing in size from 9½ inches to 85½ inches, in horsepower from 2 to 250, and in capacity from 1 to 950 tons per hour.

Details of drive method, cavity design, tramp iron protection, and self-aligning eccentric bearing also are described in the booklet, available from the company at 405 Park Avenue, New York 22.

•

Turf Fertilizer Spreader

A fertilizer and top-dressing spreader for lawns and turfs has been developed by Reginald A. Plummer of El Monte, Calif., that will handle light weight, low-density materials such as peat moss, bat guano, steer-manure, and mulches.

Mr. Plummer is interested in entering into a licensee arrangement with a manufacturer. The original spreader had a two cubic-foot capacity and was operated by pushing it like a lawn mower. Two inter-meshing brushes are used to spread fertilizer evenly.

•

New Spray Nozzle Line

A new line of spray nozzles has been introduced by the Schutte and Koerting Co., Cornwells Heights, Pa. The nozzles produce medium to coarse, evenly distributed, solid-cone sprays with a normal spray angle of 70 degrees.

The nozzles are described in Bulletin 6A-627 which can be obtained from the company at Cornwells Heights, Bucks County, Pa.

•

Deming Fertilizer Pumps

The Deming Co., Salem, Ohio, has prepared a folder describing its portable, engine-driven, liquid fertilizer pumps that are designed for field spreader or transfer service.

Bag Closure System

A new bag closure system called Chase Moistite is said to permit an absolutely moisture-proof closing of both ends of bags for ammonium nitrate, ammonium sulphate, feeds containing antibiotics and vitamins, and other products requiring maximum moisture protection. The Chase Bag Co., New York, now offers multi-wall paper bags manufactured with this Moistite tape-over-seam closure.

A Renneburg Continuous Combination Ammoniator-Granulator, a Renneburg DehydrO-Mat Dryer with special refractoryless gas-fired furnace, and a Renneburg Straight Shell Cooler . . . being installed in a 30-ton-per-hour granular plant of one of the leading mid-western fertilizer producers.

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Dow New Products Catalog

The Dow Chemical Co., Midland, Mich., has published a new edition of its products catalog describing properties and uses of 375 industrial, pharmaceutical and agricultural chemicals.

The 1958-59 issue is the fourth annual booklet issued by Dow and provides a ready reference for Dow's chemicals. It may be obtained without cost from the company.

•

Young Centrifugal Blowers

A new line of centrifugal blowers is described in a four-page bulletin issued by the Young Machinery Co., Muncy, Pa. The blowers can be furnished in carbon steel, stainless steel, or other alloys. They are hi-pressure, low volume units used as industrial exhausters and can be assembled in any position through 360 degrees, either clockwise or counter-clockwise.

•

Clark Stackers Brochure

Complete specifications and descriptions of operating characteristics of four high-lift, battery powered hand trucks are contained in a six page, color brochure available from the Industrial Truck Division, Clark Equipment Co., Battle Creek, Mich.

•

Stauffer Herbicide Brochure

The Stauffer Chemical Co., New York, has published an illustrated brochure that describes the various applications of its selective pre-emergence herbicide, "Eptam."

Included are detailed outlines of the crops on which Eptam can be used and the types of weeds it controls.

FERTILIZER VIEWS

(*From Page* 53)

the purpose of measuring the amount of variation. Experience has shown that the square root of the average of the deviation about the mean which has been *squared*—what the statistician calls the standard deviation—is the best estimate of variation. Furthermore, by squaring the item, the negative numbers are eliminated. (Squaring negative numbers results in positive values.)

From the laws of probability it is known that only 46 measurements out of 1000 will vary from the mean by more than twice the standard deviation, and only 3 out of 1000 by more than three times the standard deviation. This property of the standard deviation is important to the user of statistics. He uses it in getting and maintaining the quality of production, in establishing specifications and tolerance limits and in accepting testing results.

In the next article on this subject we shall discuss the Shewhart Chart and explain in more detail the implications of standard deviation.★★

TALE ENDS

(*From Page* 126)

And it came to pass that Ziram, son of Zineb and King of the Thanites, in the fifth year of his reign and in the month of Nirit, came forth from Niran, the city of his fathers, and went down with his army into the land of Malathion, even unto Semesan the city of the Aramites.

And Ziram laid seige to Semesan, but he could not break down its high walls builded of Mersolite stone, nor its gates of brass wrought of many plates riveted one to another to the thickness of one cubit.

So Ziram bade make ready his chariot and his swift horse Albucid—a gift from the Pharaoh Sul-Fotepp—and hastened to the city of Karmex, where he gat himself to the temple of Diazinon. And he made burnt offerings and cast himself down before the great golden image of Diazinon and pressed his forehead to the floor of the temple and cried,

"O mighty Diazinon, what must I do to force the gates of Semesan?"

And the great golden image of Diazinon made reply in a voice of thunder,

"LO ZIRAM, THOU ART IN THE WRONG TEMPLE. I DO NOT CONCERN MYSELF WITH WAR-LIKE MATTERS. IF PERCHANCE THOU DESIREST AN INCREASE IN THE FECUNDITY OF THY FIELDS, OR THY ORCHARDS, OR THY FLOCKS, OR THY HERDS OR THY WIVES, I WOULD LIST BUT SINCE THOU ASKEST NONE OF THESE THINGS, GET THEE HENCE FROM THIS PLACE AND SEEK OUT THE WITCH OF ENDRIN IN THE LAND OF HANANE, AND MAKE KNOWN THY PETITION TO HER"

So Ziram shook the dust of Karmex from his feet and mounted his chariot and journeyed to the Witch of Endrin in the land of Hanane. And when he had spoken his wish the Witch made answer,

"For the price of one roccal of gold and one roccal of silver thou shalt be shown how to break down the gates of Semesan."

And when Ziram had given the gold and the silver to the Witch of Endrin she conjured up the powerful demon known to the Aramites as Thimet, and spake to him thuswise,

"Behold, Thimet! Ziram, King of the Thanites, desireth to break down the gates of Semesan. In what wise shall he do this thing?"

Then Thimet plucked a great sword out of the air and gave it to King Ziram. The blade was wrought of strange metal that shimmered with the sheen of opals, and Thimet said,

"With this blade, Ziram, smite thou the gates of Semesan, and at the same time thou must cry with a loud voice, PARATHION! And then the gates will fall."

Now Ziram, being minded to regain the roccal of gold and the roccal of silver, raised the demon-sword and cried, "PARATHION!" and smote the Witch of Endrin.

Shrieking like a Nemagon* she was transformed to a cloud of black vapor and was no more. But Thimet the demon was thereby released from his servitude to the Witch of Endrin, and he shouted a great shout of gladness and seized the gold and the silver and betook himself thence in a blaze of green fire after the manner of demons. But, being beholden for his freedom to the sword-stroke of Ziram, the sword he took not.

So Ziram returned with all speed to his army, still lying in camp around and about the city of Semesan. And Ziram rode in his chariot at the head of his army unto the east gate of Semesan, which the Aramites call the Indalone Gate because it is the sole gate that faceth toward India. And Ziram raised the demon-sword and cried "PARATHION!" and smote the gate.

Whereupon the brazen slabs of the gate fell to the ground in an hundred and one pieces with a dire and terrible noise. And Ziram and his army entered the city and were met by Arasan, King of the Aramites, riding an elephant sheathed in jointed armor of bronze, at the head of his own army.

Then Ziram raised the demon-sword again and cried, "PARATHION!" and smote the elephant And the elephant fell in two halves, one on each side, so that King Arasan was cast upon the ground and brake his neck and was dead.

Forthwith the army of the Aramites was dismayed and fled before the army of the Thanites, and Ziram seized the city of Semesan and Queen Diazinon, the widow of King Arasan.

So the Thanites feasted and made merry in the palace of the King of the Aramites, while their hearts were made glad by dancing girls dancing to the joyful sound of the tinkling castrix and the sweet music of the bulan and the aabula.

Thus it was in the days of King Ziram of Niran, King of the Thanites, when he took the city of Semesan from the Aramites, in the land of Malathion.

*Nemagon: A species of female demon in Sumerian mythology; half woman and half vulture.

Brevities

A. J. CARRADO has been named manager of administrative services at the Henderson, Nev., plant of the American Potash & Chemical Corp.

AC

DORR-OLIVER INC., Stamford, Conn., has appointed the Simonds Pump Co. of Los Angeles, Calif., and the Simonds Machinery Co. of San Francisco as exclusive territorial distributors of D-O pumps.

AC

A. P. McGUIRE has been named plant manager of the American Chemical Corp. plant at Waston, Calif., which is now under construction. The American Chemical Corp. is jointly owned by the Richfield Oil Corp. and the Stauffer Chemical Co. Mr. McGuire had been assistant plant manager at Stauffer's Louisville, Ky., plant.

AC

THE ROHM AND HAAS CHEMICAL CO. of Canada has purchased 210 acres at Morrisburg, Ontario, for a new plant.

AC

THE ARMOUR FERTILIZER WORKS, Atlanta, Ga., now is using bags with a coating of Bakelite polyethylene to keep superphosphates dry during shipping and storage.

CAAA MEETING

(From Page 60)

He cautioned pilots who have been treated by atropine for phosphate poisoning not to return to work as soon as symptoms disappear, because the poison is still working, and a return to dusting operations may result in a more severe exposure.

Robert E. Moore, assistant executive director of the National Aviation Trades Association, spoke on the wage-hour law and called for the cooperation of CAAA members in the NATA's project to have aerial applicators exempted from the Federal Wage-Hour Act. He pointed out that applicators are not engaged in interstate commerce. He said that the NATA has been working on the matter since 1952, but that more financial support is needed to continue the project.

James K. Vedder, president of the Valley Insecticide Service Co., was elected president of the CAAA for 1959. He succeeds James B. French. Mr. French, in his outgoing address, discussed future plans for the organization and said that improved public relations is the number one project. Expansion of the placement committee service also is planned, along with increased work by the safety committee, he said.

A demonstration of aircraft and application equipment was held at the Sacramento Sky Ranch. Adverse weather conditions seriously hampered flying, but operators had a chance to see the Transland Ag 2 and discuss its features with Bat Masterson from the Transland

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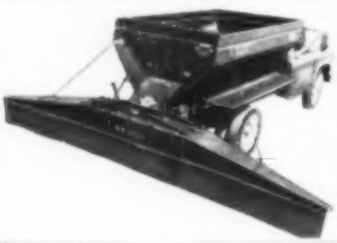
A *Powered Flow-Divider* assures even distribution of materials to both spinners, regardless of the position of the L-42S on hillsides or level ground. Customers appreciate this feature as it results in an even crop growth throughout the field.

NEW LEADER Model L-14S LIME SPREADER

is a high quality rig with a low price tag!

Cut your in-the-field costs with this simple to operate, easy to maintain spreader. Merely set the feedgate opening, start the truck, engage the PTO and start spreading! Material is delivered to the twin spinners over a wide 24" conveyor. Also available with a center dump for stock piling and windrowing.

NEW LEADER *Engine-driven* Spreaders: Model L-52S with 24" conveyor is built for widespread use. Model L-62S with a 30" conveyor is for extra heavy, widespread lime applications. Both spreaders can also be used for fertilizer.



Model L-19S Combination Spreader With PTO Drive, 24" Conveyor and Twin Spinners Delivers Fast, Uniform Spreads!

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NEW LEADER *Engine-driven* Combination Spreaders are also available: Model L-22S with a 7.0 h.p. engine and Model L-32S with a 12.5 h.p. engine to deliver plenty of power for heavy applications of lime or fertilizer.

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Co. Also on hand was the CallAir plane, and Carl Peterson of CallAir answered questions on this equipment. Other planes exhibited were two Fletchers, and a Piper-Cub, fitted with the new small Swathmaster attachment.★★

ILLINOIS SPRAYERS

(*From Page* 63)

production researcher who specializes in weed control.

The two main reasons for its poor showing, according to Mr. Slife, were lack of rainfall and insufficient application rates. In areas where rain fell shortly after application, Simazine gave significantly better weed control than in areas where no rain fell.

Rate-of-application studies show that three pounds of active ingredient should be used on soils in the northern two-thirds of Illinois. Two pounds seem enough for older soils in the southern one-third. And in areas where the soil is primarily sand, one pound of active ingredient has given good results.

Despite Simazine's poor showing in 1958, Mr. Slife feels that it will still become an important weed killer. Simazine controls a wide variety of cornfield weeds and does not adversely affect the corn.

Three new weed control chemicals for legume crops were discussed by K. P. Buchholtz, University of Wisconsin plant pathologist. They were 2,4-DB, dalapon and EPTC.

2,4-DB is similar to 2,4-D. But most forage legumes are more tolerant of the former than of the latter. As a result, 2,4-DB will control many broad-leaved weeds in stands of alfalfa, birdsfoot trefoil, red clover, alsike clover and ladino clover.

Dalapon, reported Mr. Buchholtz, has possibilities for controlling grassy weeds in alfalfa, sweet clover and birdsfoot trefoil. But because this chemical leaves a significant residue when applied to established forage, its chances for becoming recommended are slim. There is a possibility, however, that it may eventually be used on seedling legumes, as residues will seldom persist into forage harvest if the material is applied in the seedling stage.

EPTC is applied as a soil treatment. And since it must be incorporated into the soil surface, it is applied as a pre-planting treatment. Applications of 3 pounds an acre have usually given excellent control of annual grassy weeds and fair to good control of broad-leaved weeds. However, seedlings of forage grasses cannot be established in areas treated with EPTC, Mr. Buchholtz concluded.

Mosquito Control

Harold Gunderson, Iowa State College extension entomologist, urged that every community should establish a mosquito control program. He pointed out that the cost of a well-planned program is

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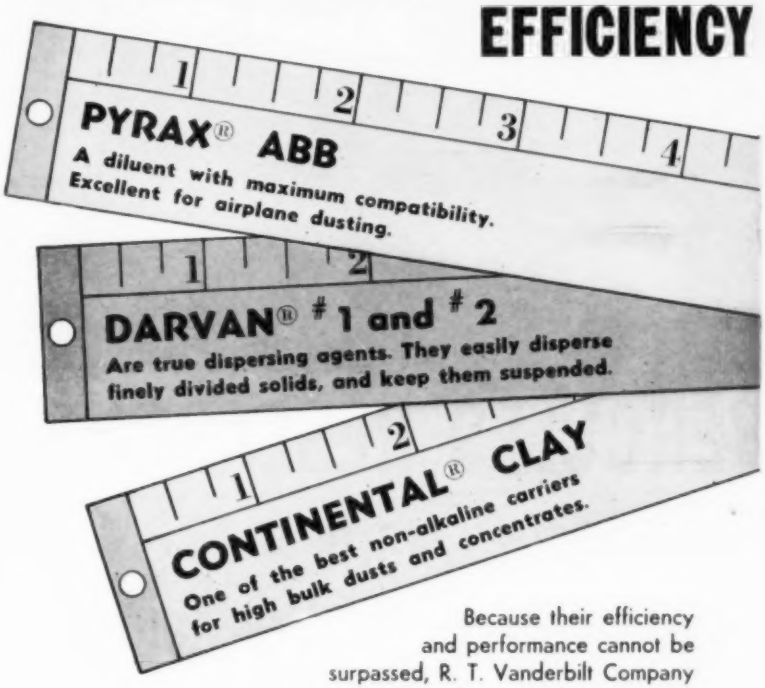

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low and results are excellent. On contained infected onions in 1955. **NO MAJOR REPAIRS**

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low and results are excellent. On the other hand, an emergency program thrown together after mosquitoes strike is expensive and generally is not effective.

According to Mr. Gunderson, *all* mosquito breeding areas within one mile of town must be located and treated. If they aren't, control efforts in town will be useless. He also urged that citizens check such things as tin cans, cisterns, rain barrels and old tires for possible accumulation of water during the summer.★★

ONION BLOAT

(*From Page* 50)

inch depth; after treatment, it was harrowed lightly to close cracks. Soil temperatures, recorded on the days when treatments were made, varied from 66° to 59°F.

Field 1 became severely infested with the nematode after infected sets were planted in 1954. In 1955, lettuce was grown to reduce the nematode population before fumigation. D-D was applied in September 1955, at the rate of 50 gallons per acre.

Field 2 produced infected onions in 1955, and nematodes were still present in bulbs left in the soil after harvest. Aero Cyanamid (47 percent calcium cyanamide), at the rate of 600 pounds per acre, was harrowed lightly into the soil, on August 30, 1955. This material has some nematocidal properties, but the reason for its use in the tests described was to induce decay of the remaining bulbs, by taking advantage of the phytotoxicity of the compound's partial breakdown products. Three weeks later, D-D was applied at the rate of 50 gallons per acre.

Field 3 contained infected onions in 1955. In September, D-D was used in a split application, the first installment at 60 gallons per acre, and the second application, made 1 week later, after the field had been plowed and harrowed, at 50 gallons per acre.

Fields 4 and 5, both of which contained infected onions in 1955, were treated with D-D at 50 gallons per acre in September 1955.

To obtain information on crop injury and on control of the nematode, the authors recorded yields for the summers before (1955) and after (1956) fumigation in each field. Yields in another field, field 6, which was not infested with the nematode and was not fumigated, were recorded for comparison. This field was adjacent to fields 2, 3, and 4. The fields were inspected carefully, and all plants showing symptoms of infection were examined in the laboratory to determine the presence of the nematode. Fields 1, 2, and 5 were inspected again during the summer of 1957, but fields 3 and 4 were dropped because they had been combined into a larger field in the fall of 1956.

Growers were asked to save bulbs that showed symptoms of bloat at harvest time, and these bulbs were also examined in the laboratory.

RESULTS:

No plants were observed to be infected in treated fields during inspection in 1956 or 1957, nor were infected bulbs found at harvest time. There was no evidence of injury to the onion crop in either year. Table 1 lists the yields obtained in the experimental fields in 1955 (before treatment) and 1956 (first year after treatment).

For comparison numerous untreated fields that were known to contain the nematode in 1955 were also examined in 1956 and 1957. Infestation in these fields became more severe each year in every case where onions followed onions.

DISCUSSION:

Fumigation with D-D provides a satisfactory and economically practicable means of controlling *Ditylenchus dipsaci* in the organic soils of southern New York. The cost, which amounts to about $75 per acre, is high but not excessive for this high-value and productive crop in this region. Telone (tech-

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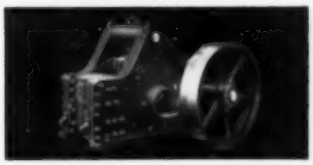
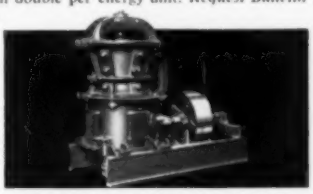
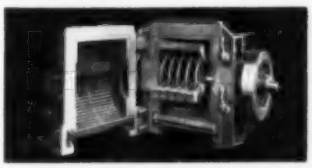


Jaw Crushers — Produce coarse (5 in. largest model) to fine (⅛ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smallest sizes operate on double cam principle — crush double per energy unit. *Request Bulletin No. 062.*



Rotary Fine Crusher — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*

Crushing Rolls — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*



Hammer Mills — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

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nical dichloropropenes), another material containing the same active ingredient as D-D, became available after these experiments were made; it is probable that this material should also be effective for this purpose.

When contrasted with the rapid multiplication and spread of the nematode in untreated soils, its apparently complete failure to survive in the treated fields is evidence of a degree of control approaching eradication. The authors suggest that the lasting effectiveness of the treatment may be due to the fact that *Ditylenchus dipsaci*, not being parthenogenetic, requires for survival the meeting of both sexes within a host plant; thus a treatment that did not actually kill every individual nematode might lead to eradication by preventing reproduction. This hypothesis is supported by the response of the root-knot nematode *Meloidogyne hapla* to similar dosages of D-D applied to organic soils. Commercially adequate control is achieved, but a sufficient number of individual nematodes survives the treatment to permit reinfestation and spread. *M. hapla* is a parthenogenetic species, that is, it can develop to maturity from unfertilized eggs, and its survival requires only that one female enter a host plant.

The discrepancy between the lack of apparent injury to onions from D-D in these tests in southern New York, even at the highest rate of a total of 110 gallons per acre in field 3, and the report of injury from as little as 45 gallons per acre in northern New York might be due to various factors, among them being different soil composition, different varieties, change in chemical content of the material since 1946, when the northern tests were made, or different environmental conditions after treatment, according to the authors. They state that although the soil of field 3 retained the characteristic odor of D-D in spring and early summer of 1956, the residue was not toxic to the crop.★★

'58 PEST CONTROL

(*From Page 36*)

spreading to other parts of the country where corn and other grass crops are grown more intensively.

Nematode Control

Pests living in the soil have presented particularly difficult problems. The soybean cyst nematode, a minute roundworm that lives on the roots of soybeans, is a case in point. First discovered in North Carolina in 1954, it has since been located in Virginia and in the five states on the Mississippi River — Missouri, Arkansas, Kentucky, Tennessee, and Mississippi. The Virginia infestation involving two fields in Nansemond County was reported in October 1958. Surveys in other states have been negative. The program is designed to contain the pest in the presently infested areas until an effective means is available to control or eradicate it. So far, the nematode has been found on some 19,000 acres in the six states, and surveys are being continued to delimit the infestations. This year, soil samples were taken on more than 16,000 properties comprising approximately 533,000 acres, and inspections of plants were made on almost 24,000 properties, representing approximately 444,370 acres.

Beetle Pests

Work continues against two other soil infesting foreign invaders — the white-fringed beetle and the Japanese beetle. More than 77,000 acres were treated for white-fringed beetle control during the year; approximately 61,000 of those received insecticide soil treatments and the remainder foliage treatments. Serious infestations of the Japanese beetle were found in widely separated locations this season. In all, 29,250 acres were treated in 1958 — 22,000 acres with granular insecticide and the remainder with foliage sprays. These annual suppressive measures have done much to prevent the buildup and spread of these pests into new regions.

Hoja Blanca Disease

Hoja blanca disease of rice, discovered for the first time in this country at Belle Glade, Florida, was found in 1958 in three fields near Bay St. Louis, Mississippi. This discovery poses a serious threat to commercial rice production in the Mississippi Valley States. The disease is prevalent in Cuba, Costa Rica, Panama, and Venezuela. The infected rice and suspect grass hosts in Florida were sprayed with an insecticide to kill a species of leafhopper, the vector of the disease, and all rice in the area was grubbed out or plowed under. So far this year in Florida, the disease has not been found, and only twice was the vector collected. The infected area of Mississippi is now under treatment, and surveys have been extended to the important commercial rice-producing areas of Mississippi, Texas, and Arkansas.

Survey, control, and eradication work are only part of the comprehensive program against plant pests conducted by the U. S. Department of Agriculture. Other phases include: Port-of-entry inspections to protect against the introduction into this country of pests from abroad; Federal-State quarantine and regulatory measures to contain many pests; and a disease and insect detection and reporting system.★★

FUNGICIDES

(*From Page 40*)

form such as "snow" so that they will go into solution readily. Bordeaux mixture is usually made at the site of use, i.e. on the farm, for the freshly prepared homemade product is superior to industrial preparations. The latter, however, may be more convenient for home gardeners. Among fungicides, properly prepared Brodeaux mixture is outstanding in its ability to

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stick to foliage and resist loss by weathering.

Bordeaux mixture tends to injure plants and so the less toxic insoluble or fixed copper fungicides have been developed. Most of these contain basic copper chlorides such as Copper Hydro, Cuprenox Microgel or basic copper sulfate as Basi-cop and Tribasic or a mixture of both as C.O.C.S. The use of cuprous oxide (e.g. Yellow Cuprocide and Robertson's Fungicide) as a foliage spray and seed treatment is diminishing. Copper zinc chromate also has limited use.

The copper fungicides are most widely used as foliage sprays on potatoes, tomatoes, other vegetables, grapes and ornamentals. Immense quantities of Bordeaux mixture have been used in tropical America to control the Sigatoka leaf spot disease of banana.

(*Conclusion in April*)

LIQUID DISTRIBUTOR

(*From Page 37*)

he has a record of each delivery. In providing service, our deliverymen have instructions to check the tank and feeder to make sure that the float is clean and proper practices are being followed. If they are not, the deliveryman either contacts the farmer or reports to our office and we contact the farmer. This vital link in our service convinces customers of our interest in their success and assures us of continued good business.★★

ORGANIC WASTES

(*From Page 42*)

1. Different forms of chemical nitrogen have encroached on the former organic field.
2. Higher analysis mixed fertilizers are in high demand, and
3. Certain organics compete in the animal feed markets. The fertilizer industry cannot successfully compete with animal feeds.

Some of the materials to be considered here include seedmeals, pomaces, tankages, and fish products. Data in Table 7 reveal some marked changes in the marketing of certain of these products during the past half century.

Cottonseed was once a waste product, spread on the land for soil improvement. When the oil was first utilized as human food, the meal was not considered suitable for animal feed. Later the poisonous constituent, gossypol, was partly removed in processing, and the feeding of cottonseed meal was better understood. This rapidly led to consumption of cottonseed meal as animal feed. Its use as a fertilizer then correspondingly declined.

Before the days of modern refrigeration and rapid travel of fishing boats at sea, fish in varying stages of decomposition were brought to land. They were sprinkled with sulfuric acid to abate the odor and were processed as fertilizer. Now the tonnage of fish products thus treated is small.

Castor pomace represents the opposite trend. This material is poisonous to animals, but is suitable for the fertilizer industry. Tungnut pomace, though usually in small tonnage, is used in the same manner as the corresponding product from castor beans.

Linseed meal and castor pomace each have a nitrogen content of slightly more than 5 per cent. If each is considered as containing 5.5 per cent nitrogen, the cost of the nitrogen as currently quoted wholesale is about 51 cents per pound in the form of linseed cake, and 36 cents for the nitrogen castor pomace. Chemical nitrogen such as ammonium nitrate is currently quoted at about 10 cents per pound wholesale. Various feed materials such as soybean cake and cottonseed meal are comparable in nitrogen value to that of the linseed product. On the other hand, activated sewage sludge, whose nitrogen content is often comparable to

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that of some of the seedmeals, sells wholesale f.o.b. on a nitrogen basis for about 25 to 40 cents per pound. The price depends to some extent upon the physical condition of the material, whether dusty or pelleted, and to some extent upon the publicity given to a product that is fundamentally good for the purposes indicated.

Why are growers of plants willing to pay for organic forms of nitrogen more than double the price asked for inorganic forms? The reasons are several: (1) crop plants are less injured from misuse of organic forms of fertilizer than is likely when water soluble forms are used; (2) the natural organics contain variable amounts of secondary and minor elements that may or may not be needed; (3) the grower often erroneously thinks that he is making an important contribution to the humus content of the soil, with the small poundage added per acre; and (4) the nitrogen of good quality organics is often desired by growers of tobacco and certain other crops, particularly on sandy soils.

Animal tankage mostly moves in the animal feed markets; so very little is available at a price fertilizer users are willing to pay. Garbage tankage is is garbage product from which most of the fat and water have been removed. A moderate tonnage of process tankage, however, is used in spite of very low prices paid for the crude fat so prominent as a by-product in its preparation.

Mention may be made in passing of such materials as recovered cannery wastes, coffee grounds from the instant coffee industry, wastes from processing of cocoa beans, and many other by-products from the utilization of agricultural crops. These materials should be utilized for soil improvement, but economic aspects of their salvage are not very promising.★★

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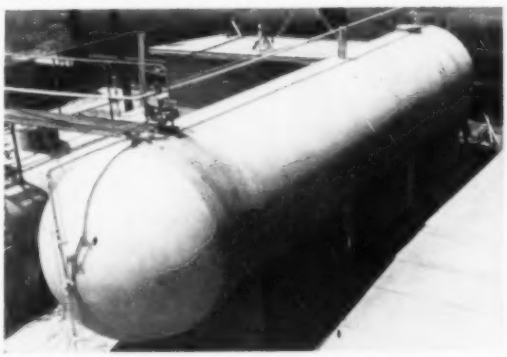
GRAN. INSECTICIDES

(*From Page* 31)

saying little more than that the solvent should be a nonphytotoxic hydrocarbon, and that the finished formulation should be flammable. Nowadays there are definite limits on physical properties of the solvent, including initial, median, and final boiling points, flash point, specific gravity, and viscosity.



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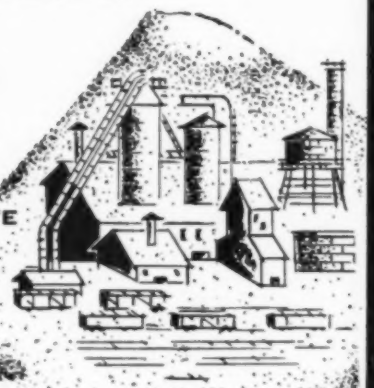

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The limits are so chosen as to admit several well-known brands and grades that have given satisfactory service, and to eliminate almost anything else that is not their equivalent. The amount of solvent is often fixed at about 20% of the finished mixture, though sometimes much less is desired. A weakness remaining is the lack of any convenient quick test for freedom from serious phytotoxicity.

(3) *Chemical stability.* For a long time, no safeguard for stability existed in the purchase descriptions. Now the dieldrin formulations are required to contain urea as a deactivator, added to the attapulgite and blended in before introduction of the dieldrin solution. The same problem exists with several other toxicants, and in each case it must be solved (a) by specifying both the carrier and the deactivator, (b) by specifying a carrier known to be safe, or (c) by providing a stability test for purposes of acceptance. Any of these methods may be adopted with dieldrin and aldrin, but with certain of the other toxicants the stability-test plan is complicated and has not been worked out satisfactorily.

(4) *Grain-size distribution.* The difficulties have been with the fine end of the range. The fundamental problem is to avoid undue dustiness. The measure of dustiness used commonly is the percentage passing the 250-micron (U. S. No. 60) sieve by dry test; this is about the coarsest sieve that is applicable to dust evaluation. Hundreds of tons of material have been supplied to meet specifications limiting the fine (under 250 microns) fraction to 5%.

Further problems relating to the fine fraction, on which study is being continued, are: (a) the difficulty of determining this fraction, due to unsatisfactory reproducibility of known methods; (b) variation of the fines with storage time—a variation that is unpredictable and sometimes erratic; and (c) the troubles due to packaging and shipping before sufficient curing time has elapsed. Strange to say, this practice can result in delivery of a product that is still damp or, on the other hand, one that is dustier in the acceptance test than it would be after a reasonable storage period.

(5) *Bulk density.* There was formerly a requirement on this property—a minimum of 0.07 g/cc, as determined with the Scott volumeter. Bulk density as a property is still considered very important in practice, especially in application by airplane, but with the composition and grain-size distribution closely specified, the bulk density follows automatically, so that its inclusion in the specification is unnecessary.

(6) *Grain breakdown.* Present Interim Federal Specifications, like some of the preceding purchase descriptions, contain a test for ease of breakdown under the action of water. In the early history of the test a water spray was used; in the latest procedure the sample is tumbled with water in a jar. This test also needs further improvement in reproducibility.

Summary

THE granulated insecticides constitute a relatively new and increasingly popular physical type, with demonstrated advantages in a number of special applications where fine particle size is unnecessary or undesirable. Progress has been made in improvement of specifications through closer standardization of ingredients and elimination of certain superfluous tests. Major problems confronting further development of this class of materials are: (1) control and evaluation of dustiness, (2) evaluation of entirely new or insufficiently tested carriers, (3) further insurance against chemical instability and phytotoxicity, and (4) anticipation of stock requirements to allow adequate curing time.★★

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EDITORIAL

(*Continued from Page 27*)

while agricultural crops — at the farmer level — have increased in value more than 264%.

So long as any investigation of fertilizer prices is conducted fairly, the industry has nothing to fear from it. If the investigators are interested in true facts, — and if they are brought out, — they should establish without question that plant food is one of the biggest bargains in the farmer's shopping bag.

WASHINGTON REPORT

(*From Page 69*)

standing timber that fire does, the Admistration plans to cut funds for forest insect and disease control by more than $800,000 for the 1959 60 fiscal year.

The most palpable reason offered is that spraying for insect control in the Northwest has been so successful over the past ten years that natural predators are now able to handle the job with the aid of insecticides. The proposed cut is from $6,608,600 appropriated in 1958-59 to $5,881,800 for 1959-60. These funds are administered by the U. S. Forest Service.

It is interesting to note that U. S. Forest service funds for insect and disease control will still be about $1,800,000 more than their funds for fire fighting for the upcoming fiscal year. The fire fighting funds are set at $5,000,000, the same as for 1958-59.

Funds proposed for forest protection research—covering fire, insects, and disease—during the coming year will be $2,440,000. This is the same amount appropriated for these purposes for 1958-59.

AC

If you've wondered why so many representatives of pesticides manufacturers visit Washington, you can now sit back and relax. The answer is in this year's NAC listing of pesticide tolerances. The new book on tolerances lists 324 changes or additions in the 12 months since March 1, 1958.

That averages out to more than six new tolerances a week. The vast majority, of course, are changes for existing chemicals and crops. The changes and additions bring total number of tolerances to about 1300 as of March 1, 1959.★★

CAKING

(*From Page 29*)

shown in Table III. The formula made with desiccated superphosphate behaves irregularly. It probably cures at times in the first phase, sometimes in the second and sometimes not at all. The common formula has the same behavior to a smaller degree, but the addition of water guarantees curing.

(*Concluded next month*)

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PLANT QUARANTINE

(*From Page 46*)

treatment had extensive early use on imported narcissus bulbs for bulb fly and nematode control, but it is now used mainly as a nematode treatment on certain dormant plants.

Recent developments that show promise as quarantine safeguards are aqueous dips of ethylene dibromide at 115°F. for the control of fruit flies and ionizing radiations for the control of fruit flies and other insect pests.★★

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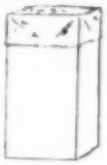

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Quarantines and Administrative Instructions

Horticultural Board (HB):

195. May 4, 1926. Disinfection of narcissus bulbs.

Plant Quarantine and Control Administration (PQCA):

252. Oct. 23, 1929. Sterilization of grapefruit by use of heat under Mediterranean fruit fly regulations.

271. March 4, 1930. Additional method of sterilizing Florida citrus fruits by refrigeration authorized.

311. May 8, 1931. The importation under permit of frozen-pack fruits authorized.

Bureau of Entomology and Plant Quarantine (BEPQ):

462. Sept. 15, 1937. Restrictions affecting the importation and interstate movement of frozen-pack fruits.

464. Sept. 15, 1937. Importation of vinifera grapes and certain other deciduous fruits subject to in-transit sterilization authorized.

481. Oct. 19, 1949. Vapor-heat treatment approved for certain fruits and vegetables under Hawaiian fruit and vegetable quarantine No. 13.

542. Rev. Nov. 20, 1952. Amendment of administrative instructions prescribing method of treatment of certain fruits from Mexico. Rev. Dec. 11, 1953. Modification of administrative instructions prescribing method of treatment of oranges, grapefruit, tangerines, and Manila mangoes from Mexico.

575. Feb. 1, 1949. Administrative instructions prescribing methods of treatment of grapefruit and oranges under Mexican fruitfly quarantine.

585. March 9, 1950. Administrative instructions authorizing the movement from Hawaii of frozen fruits and vegetables.

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Plant Quarantine Division (PQ):

481. Amended Sept. 24, 1954. Amendment of administrative instructions prescribing methods of vapor heat treatment of certain fruits and vegetables from Hawaii.

583. Nov. 17, 1949, as amended through July 6, 1957. Administrative instructions for cold treatments of imported vinifera grapes and certain other fruits.

[1]Acknowledgment is made, with thanks, to G. F. Callaghan and other members of Plant Quarantine Division for these figures.

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AERIAL APPLICATION

(*From Page* 57)

vestigated by the Portion group is the correlation of micrometeorology and spray deposit and drift. Basic turbulence studies at Portion have been coupled with field investigations in East Africa to try and obtain data which can be used to establish certain weather criteria on which the effectiveness of a given spray application may be predicted and evaluated.

In Holland, the Shell Oil Company has carried on agricultural investigations with emphasis on the use of helicopters. The high speed fluid kinetic laboratory at the Shell Company in Delft has a cathode tube type (Mullard) droplet counter and sorter. Government support for aircraft work seems to be centered at the agricultural research unit associated with the University of Wageningin, near Utrecht. Here the Plant Pathology Division, in cooperation with Horticultural Engineering, has conducted spray pattern and deposit tests in a laboratory spray tower. At present they are working with the Mechanical Engineering section of the University (not at Wageningin) making studies on the airflow pattern affecting spray distribution produced by a ram jet helicopter in simulated flight in a wind tunnel.

The Belgians and French reportedly are working with helicopters for agricultural spreading of chemicals, with considerable interest being shown in the use of electrostatic charging of dust and spray particles for greater deposit. Bayer Chemical Company at Leverkusen and the Engineering Department at Gottingen in Germany also have been conducting experiments in electrostatics, but the results appear to be in keeping with the findings at Michigan State University where it was decided that the increase in field deposits by the use of charged particles did not live up to that obtained under the controlled laboratory conditions, and was not sufficient to justify the equipment cost.

The Colonial Pesticides Research Unit at Arusha, Tanganyika, is a part of the English Colonial Research and Development organization with headquarters in London. An Auster J5 equipped with typical boom and nozzle spray equipment, and also the Britten-Norman whirling cage devices were made available for our use about the time we arrived in Arusha in November of 1957. During the next eight and one-half months we were able to run a series of trials using this aircraft for spray deposit and drift work with the two available systems and the range of flow and drop adjustment they provided.

Agricultural aircraft research activities in the United States are carried on by (1) federal government agencies, such as the USDA, (2) state experiment stations, with both direct and indirect federal support, and (3) certain private groups, usually commercial in interest.

New projects on agricultural aircraft are being initiated at certain state experiment stations, such as Nebraska and Mississippi, and in Canada at the Agricultural Engineering Department, University of Ontario, Guelph. The earlier Texas Personal Aircraft Research Center, which contributed greatly to the development of safety and operational design of agricultural aircraft has gone through reorganization. The work at Texas utilizing the unique balances for catching spray and granular materials led to the development of compensated dry material spreaders which greatly increased uniformity of dry materials swath patterns and also swath widths. The Texas center is, of course, widely known for the development of the AG series of planes; AG I, a low wing monoplane which later became the basis of the commercially built AG II; and AG III, a Piper aircraft modified low wing design.

Industry and private research groups have not contributed greatly to any basic research on agricultural aircraft usage; their principal contribution is of course the airplane itself. Many new planes have been made available both here and abroad, which are being used for agricultural chemical application work. A few, such as the CallAir and the AG II, have been designed and are being sold and used almost 100 per cent for agricultural work. However, it still remains true that the first requirement of any agricultural plane is that it must fly, and that once it does, its characteristics as an agricultural material spreader are very much common to all aircraft. The principal difference in design is the number and placement of wings, the overall size of the plane, and the size and shape of the engine.

Two new spreaders, the Nissen Span-Flow and the Swathmaster, have appeared to replace the old venturi devices. Each of these new rigs utilizes the basic spreading effect of an airfoil closely coupled to two (Span-Flow) or to numerous (Swathmaster) discharge points to aid in promoting rapid initial spreading of the materials. In the case of high wing monoplanes, this additional airfoil is said to countribute significant additional lift and undoubtedly aids in getting materials away from the propeller wash and into wing vortices.

It would appear that the increasing activity in research work all over the world is gradually catching up with the development of the industry and could well aid in leading the use of aircraft into a new phase of utilization to the benefit of all agriculture. Certainly aircraft has become an established way of handling the increasingly complex problems of pesticides, seeding, and fertilizer applications and will continue to press hard on the traditional ground applications even in such areas as orchards, vineyards, and other tall crops. For large-scale field applications the aircraft fast is becoming the accepted means of application the world over.★★

INDEX to ADVERTISERS

Allied Chemical Corporation—Nitrogen Division ..... between 94, 95
American Agricultural Chemical Co. ..... Feb.
American Cyanamid Co. 11, 26
American Potash & Chemical Corp. ..... Feb.
Amoco Chemicals Corp. 80
Antara Chemical Div., General Aniline & Film Corp. ..... Feb.
Ashcraft-Wilkinson Co. ..... Dec.

Bagpak Div., International Paper Co. ..... Feb.
Baughman Manufacturing Company 112
Bemis Bros. Bag Co. 92
Bradley Pulverizer Co. 22

Call Air 58
Chase Bag Co. ..... Feb.
Chemagro Corp. 4
Chemical Construction Corp. 13
Chemical Insecticide Corp. 114
Clark Equipment Co. 25
R. D. Cole Mfg. Co. 115
Combustion Engineering, Inc. Raymond Division 17
Commercial Solvents Corp. 70
Continental Can Co., Flexible Packaging Div. ..... Dec.
Cox, Dr. Alvin 123

Davies Nitrate Co. 121
Davison Chemical Co., Division of W. R. Grace & Co. 86
Dorr-Oliver Co. ..... Feb.
Duval Sulphur & Potash Co. ..... Dec.

Eastern States Petroleum & Chemical Corp. 7
Eastman Chemical Products, Inc. ..... 3rd Cover
Emulsol Chemical Corp. 12
Escambia Chemical Corp. 112

Fairfield Chemical Div., Food Machinery & Chemical Co. 20
Fischer & Porter Co. 51, 52
Flexo Products, Inc. 118
Floridin Co. 14
Fluid Energy Processing & Equip. Co. 90
Frontier Chemical Co. 21
Fry Co., Geo. H. 117

Geigy Agricultural Chemicals ..... Feb.
General Chemical Div., Allied Chemical Corp. 18
General Reduction Company 105
Glendon Pyrophyllite Co. 113
Glenn Chemical Corp. ..... Feb.
Grand River Chemical Div., Deere & Co. 72
Greeff & Co., R. W. 120
Grinnell Co. ..... Jan.

Hahn, Inc. ..... Feb.
Hercules Powder Co. 108
Highway Equipment Co. 106
Hi-Shear Rivet Tool Co. 54
Hooker Chemical Corp. 96
Huber, J. M. Corp. ..... Feb.
Hudson Pulp & Paper Co. 49

International Minerals & Chemical Corp. ..... 16, between 68, 69

Johns-Manville Co. 8

Kellett Aircraft Corp. ..... Jan.
Kennedy Van Saun Mfg. & Eng. Corp. ..... Feb.
KLM Royal Dutch Airlines 122
Kolker Chemical Corp. ..... Feb.
Kraft Bag Co. ..... 2nd Cover

Magnet Cove Barium Co. ..... Feb.
Mine Safety Appliances Co. 114
F. E. Myers & Bros. Co. ..... Feb.

National Potash Co. ..... Feb.
Niagara Chemical Div., Food Machinery & Chemical Corp. 19
Nitrogen Division-Allied Chemical Corp. ..... between 94, 95

Olin Mathieson Chemical Corp. ..... Feb.

Donald Palmer, Inc. 120
Phelps Dodge Refining Corp. 24
Phillips Chemical Co. ..... Feb.
Piper Aircraft Corp. ..... Feb.
Potash Company of America 3
Prentiss Drug & Chemical Co. ..... Feb.

Randolph Products Co. 60
Raymond Division, Combustion Engineering, Inc. 17
Reideburg, Theodore Associates 123
Renneburg & Sons Co., Edw. 103
Republic Steel Corp. ..... Feb.
Richardson Scale Co. ..... Dec.
Rohm & Haas Co. ..... 4th Cover

Scientific Associates, Inc. 114
Shell Chemical Corp. 44
Snell, Foster D., Inc. 123
Southeastern Clay Co. 101
Southwest Potash Corp. 88
Spencer Chemical Co. ..... Feb.
Sperling Laboratories 123
Spraying Systems Inc. 118
Standard Agricultural Chemicals, Inc. 84
Standard Oil Co. (Indiana) ..... Feb.
Stauffer Chemical Co. 61
Stepan Chemical Co. ..... Jan.
St. Regis Paper Co. ..... Feb.
Sturtevant Mill Corp. 109
Swift & Co. 15

Tennessee Corp. 23, 116
Texas Co. 82
Texas Gulf Sulphur Co. ..... Feb.
Thos Alabama Kaolin Co. ..... Feb.
Townsend, Dr. G. R. 123
Transland Aircraft 54

Union Bag-Camp Paper Co. 100
Union Carbide Chemical Co. ..... Dec.
United-Heckathorn 64
U. S. Industrial Chemical Co. 75
U. S. Phosphoric Products, Div. Tennessee Corp. 66, 67
U. S. Potash Co. 6

Vanderbilt Co., R. T. 107
Velsicol Chemical Corp. 99
Victor Chemical Corp. 77, 78

West Virginia Pulp & Paper Co. 10
Wilson & Geo. Meyer Co. ..... Dec.
Wisconsin Alumni Research Foundation 120
Dr. Wolf's Agricultural Labs. 123
Woodward & Dickerson, Inc. 116

Young Machinery Co. ..... Feb.

TALE ENDS

HAVING dropped out of the DDT market last year, Michigan Chemical Corp. announced last month that it plans to stay out until DDT prices get back to a level that will afford producers a profit. In its annual statement, Michigan Chemical reported profits in 1958 were seriously affected by a strike and by the closing of its DDT business. Earnings were down to .51 per share as compared with $1.09 for the previous year. The company has liquidated all inventories of finished DDT products, and is now using some of the DDT plant equipment for other purposes.

AC

Another of the basic insecticide producers, American Cyanamid Co., announced it has discontinued sale of technical methyl parathion — giving no special reason for the decision. Many in the insecticide field believe, however, that the recent sharp decline in price (down 21¢ since April) is among the major factors.

Monsanto Chemical Co. and Victor Chemical Co., both producers of methyl parathion, expect to continue to market the product.

AC

The Antitrust and Monopoly Subcommittee of the Committee on the Judiciary expanded its inquiry into administered prices to cover fertilizers in addition to its other projects. Farm machinery replacement parts may also be added to the list.

Questioned as to "whether the antitrust laws are inadequate," Senator Kefauver—chairman of the Senate Subcommittee on Antitrust and Monopoly Legislation—stated that the antitrust statute has proved inadequate to maintain competition. He ties current high prices to "unchecked pricing practices of certain industries."

AC

Out of the frying pan into the fire department: Last November at the National Aviation Trades Association Convention in Milwaukee, Alan R. Nye, an ex-crop duster, won the dubious title of "most unpopular man at the meeting." Seems he was ghosting around the convention with the head of the local teamsters' union, trying in a sneaky sort of way to steer his ex-co-workers into the union. He was finally ordered out of the convention after some unwelcome late hour unioneering in one of the hospitality suites—and was lucky to escape the intentions of several important aerial applicators, who were planning to give him the order of the fat lip.

When questioned by your *Agricultural Chemicals* reporter as to why he was involved in this union activity, Nye declared "I'm the kind of a fellow who needs a purpose in life." Last month Nye possibly found his purpose in life. He was arrested by the Havana, Cuba, police and is currently still in jail there on charges of plotting to kill revolutionary chieftain, Fidel Castro for $100,000, offered by one of Batista's supporters.

AC

The Ford Motor Co., which includes farm equipment among its enterprises, will publish a monthly agricultural newsletter that will be distributed to 16,000 county extension agents and vocational agricultural teachers.

AC

A short time ago, one of our readers, Norman Knight of Maryland, sent in the following commentary, which we thought you might enjoy reading:

The so-called Book of Phygon is well-known among students of archaeology as an ancient Sumerian writing dating from circa 2500 B. C. It is the second part of a narrative concerning the exploits of three outstanding rulers of Sumeria—namely, Sargon, Phygon, and Spergon—as well as certain contemporary minor kings. This trilogy survives only as fragments of the original and in quotations by later authors. Another hitherto missing portion of the Book of Phygon, relating to one of the minor kings above mentioned, has come to light during the excavation of the buried city of Erbon in Mesopotamia. A translation is given herewith:

(*Continued on Page* 104)

A TYPICAL AGRICULTURAL CHEMICALS SUBSCRIBER SAYS

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PHILIP S. CATIR
Eastern States Farmers' Exchange
West Springfield, Mass.

. . . it affords us a clear, comprehensive, current action-panorama of the many integral parts of the agricultural chemical industry. The passing parade of people, plants, and products making up this vigorously growing industry is of vital interest to regional organizations, such as the Eastern States Farmers' Exchange. In constantly striving to present to growers of the Northeast the most effective pesticide program possible, we certainly consider that Agricultural Chemicals is one of our real aids."

The Eastern States Farmers' Exchange is a cooperative purchasing agency for farmers of the New England States and Pennsylvania, Maryland, and Delaware. The annual gross volume of business runs well over $80,000,000 for the Exchange's six commodity divisions (Feed, Seed, Fertilizer, Husbandry, Farm Supplies, and Agricultural Chemicals). The Agricultural Chemicals Division operates through a network of three central plants and 405 dealers, supplying farmers with a complete line of pesticides. Mr. Catir is manager of agricultural chemicals production and is responsible for all production, purchasing, pricing, and inventory control for the division. He has been with Eastern States since 1951.

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isobutyronitrile
manganese sulphate (Tecmangam)
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